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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

VOLUME XVII.

JANUARY TO DECEMBER 1918.

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ERRATA IN VOLUME XVII.

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,,	104	,,	Recources *read* 'Resources'.
,,	108	,,	Benicasa cerifera *read* 'Benincasa cerifera'.
,,	120	,,	Crotolaria juncea *read* 'Crotalaria juncea'.
,,	145	,,	Vol. XIV, No. 4, *read* 'Vol. XVI, No. 4'.
,,	152	,,	Vol. XIV, No. 4, *read* 'Vol. XVI, No. 4'.
,,	153	,,	Agave Keratto *read* 'Agave Karatto'.
,,	172	,,	Ipomea sp. *read* 'Ipomoea sp'.
,,	191	,,	Astragalus baeticus *read* 'Astragalus boeticus'.
,,	381	,,	Australia *read* 'Austria'.

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Outlook for the Sugar Industry in the Smaller West Indian Colonies.

THE high price of sugar, owing to war conditions, has not unnaturally led to a considerable increase of the acreage put under sugar-cane in the smaller British West Indies in the last two years. There has also been a more cheerful tone with regard to the future of the sugar-cane industry in the utterances of those interested. In view of this condition it may be well to consider the position of these islands as sugar producers, and the factors which will tend to the permanent stability of the industry, or otherwise.

In the first place, it is reasonable to hope that the sugar-cane will be freed in the future from any handicap in the shape of bounty-fed sugar produced from beet. But, on the other hand, it is to be remembered that the sugar-beet industry has attained vast proportions, and is conducted on most highly organized and scientific lines, so that, even apart from bounties, it must remain a most powerful factor in fixing the price of sugar throughout the world. Unless cane sugar can be profitably put on the market at a cost no greater than can be done with beet sugar, the growers of sugar-cane and the manufacturers of cane sugar will necessarily be in as difficult a position as they were ten or twenty years ago. It is well to remember that the world's beet-sugar crop of 1911-12, according to Dr. Prinsen Geerligs (*The World's Cane Sugar Industry*, p. 39) was estimated at 6,801,000 tons against 8, 648,010 tons of cane sugar.

Another fact has to be steadily faced by those interested in the sugar-cane industry of the smaller West Indian islands. The total production of cane sugar in all of them is absolutely a mere nothing as compared with the total output of cane sugar in the world, or even relatively, as compared with the production of any large sugar-making country. The total output of cane sugar in all the West Indian islands, leaving out Cuba and Porto Rico, was in 1910 only 282,000 tons, to which total the smaller British Colonies of Barbados, the Windward Islands, and the Leeward Islands only contributed 68,740 tons, which is much less than one large factory in Porto Rico, the Guanica Central, made this last crop, not to speak of the large factories in Cuba. It is therefore certain that these smaller islands must be able, if their sugar industry is to continue, to produce it at as low a price as it is produced in these larger places, the conditions of production, at

least as regards climate and probably soil, being very similar to one another.

It would be a very false idea, to assume that because of their small size and relative unimportance, these islands could be exempt from economic laws. It is true that legislation under war conditions has taken great strides in a socialistic direction, and that, even after the war, it may not be possible for any man to produce just what he pleases, and as he pleases. But it is most improbable that under any circumstances the price of a product like sugar would be legislatively fixed higher than necessary, only for the benefit of the small producer. It is to be hoped that in the future it will be impossible for any commercial 'trust' or 'ring' to squeeze out small producers by any fictitious lowering of prices with a view of a forced rise to follow at the ultimate cost of the consumer. Although therefore it may happen that the minimum prices of necessary commodities may be fixed by Government Departments when peace conditions once more obtain, as they have been fixed to meet war needs, yet it appears certain that any such regulations will be made with a view to the benefit of the greatest number, i.e. the consumers, and that any commodity will have to be produced at the lowest cost possible. In any such legislation it would be almost certain that the wage earners will receive great attention, and that minimum wages will be fixed, if minimum prices are.

Now, in view of these considerations, is it possible that the sugar-cane industry of these islands can continue, and expand, as it certainly might do, within reasonable limits?

One of the chief reasons of the rapid decline of the sugar-cane industry in the trying times of the latter part of the last century was, as regards most of the islands, the low rate of wages. This was not altogether the fault of employers. Those who kept on growing and making sugar were doing so more often than not at a loss, and with the probability of final ruin facing them. They could not pay better wages because they had not the means of doing so. On the other hand, the West Indian labourer, though accepting the situation more or less calmly, very naturally gave only a little work for his little wage. And further, the industrious ones emigrated in numbers to places like the Panama Zone, Santo Domingo, and even to the United States and Canada, where although the work was harder, and the cost of living higher, the wages to be earned were also much more. The result was that in most of the islands the labour supply deteriorated both in quality and quantity.

In considering the question of the future cost of sugar production, attention will have to be paid to the wages side. The end to be striven for is a fair day's work to command a fair day's wage, which will enable all employès in field or factory to live healthily and contentedly. What the rate of wage should be can only be settled by careful consideration and co-operation. We feel convinced that one great solution of the labour question will be the increase of individual man-power by a scale of wages which will be an incentive to individual industry.

But the question still remains how the planters, in face of the certain return to normal prices for sugar, are to increase their wage bill. This it seems can only be done by increased production, and by lowering the cost of production in other directions. To begin with the production of the raw material: the tonnage of canes per acre can be increased, and ought to be increased. Where plant canes are concerned, any thing less than 30 tons an acre should be considered too low. Planters will have to strive continually for better results, and not to remain passive, with the notion that what was good enough ten years ago is good enough still. It is a good omen that there are signs of a progressive attitude of mind, and a readiness to try new methods manifest among the planters. This appears to have been a good result of hard times. It is to be hoped that the sunshine of present prosperity will not cause any diminution of alertness of mind and effort.

The process of manufacturing the cane juice into sugar has of late years been brought to a high state of efficiency in some cases in these smaller islands, as the report on the Antigua and St. Kitts Factories, in No. 405 of this Journal, shows. It may pay perhaps in the future completely to refine the sugar at its place of origin as a further step in progress. In this direction, however, it may be well to point out that there may be a possibility of making better use of what may be termed by-products. Should alcohol largely take the place of petrol for use in motor engines, which seems at least very possible, the manufacture of this for commercial purposes from the molasses, might well form a remunerative adjunct to every sugar factory. Again, it may be possible in the future that it will be remunerative to recover the wax on cane stems, or the salts from megass, or to utilize the latter for paper making. So that even the sugar manufacturer has no reason to cease from efforts after progress.

Lastly, if the sugar industry in these small islands is to remain on a firm basis, there must be greater co-operation among all concerned. The planter and the labourer must co-operate in getting as much out of the ground as possible, and in fair sharing of profits; the manufacturer must co-operate with the planter by getting all that is possible out of the cane, and in equitable sharing of the profit accruing therefrom. The day will soon be past when it will be any longer allowed for any man, or body of men, selfishly to amass great wealth at the expense of others. But the day is not past for those interested in the sugar-cane industry in the West Indies to make a decent living, with moderate profits, by putting into their business, energy, science, and fairness.

SUGAR INDUSTRY.

SUGAR-CANE EXPERIMENTS IN TRINIDAD, 1915-16.

In the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Part 3, 1917, which has recently been received at the Head Office of this Department, there is a report on sugar-cane experiments, 1915-17, by Mr Joseph de Verteuil, F.C.S., Superintendent of Field Experiments. A summary of this will be of interest to cane planters in other islands.

The experiments were conducted at the Government estate, St. Augustine, and the canes experimented with consisted of plant canes, and first and second ratoons. The plant canes received pen manure at the rate of about 15 tons per acre. No manures were applied to the ratoons, and all the canes received ordinary estate cultivation.

The weather conditions during the season are reported as having been favourable, and a high tonnage of cane per acre was obtained. The quality of the juice was also above the average.

Apparently the standard cane is still the Bourbon. It would be very interesting to know if the name is authentic, in the sense that the cane so called in Trinidad is the same as the old Bourbon of the smaller islands. This standard cane gave a calculated yield in plant canes of 37·84 tons per acre, and 3·25 tons of sucrose in juice. Of the thirty-three other varieties experimented with, twenty-five have done better than the Bourbon, some of them giving very high returns. The highest results were obtained from B.156, with a calculated yield of 52·27 tons of canes, and 5·06 tons of sucrose in juice per acre. The next ten varieties on the list also show remarkably good returns, none being below 40 tons of canes or 4 tons of sucrose per acre.

The first tests were made in March 1917, when the canes were from seventeen to eighteen months old. Mr. de Verteuil considers that the quality of the juice in these tests was comparatively poor, as the canes had not reached maturity. This was borne out by the fact that the quality of the juice was much improved in a second test made in April, thus leading him to consider that under normal conditions plant canes do not appear to be fully ripe at St. Augustine before April.

With regard to first ratoons, the first tests were made with ratoons reaped only eleven months after the harvesting of the plant canes of the same plots The returns from these were also excellent in most cases. Here, however, the Bourbon came out last on the list, with a calculated yield of 10·73 tons of cane, and 1·07 tons of sucrose in juice per acre. B.156 took the sixteenth place with 20·40 tons of cane and 2·12 tons of sucrose in juice per acre. The first place was held by D.504, with 28·08 tons of cane, and 3·18 tons of sucrose per acre. Of the leading twenty none fell below a calculated yield of 18 tons of cane or 2 tons of sucrose per acre. A second test made with ratoons when they had been twelve months growing, showed that hardly any of the varieties reaped at eleven months were really mature

The four varieties of Hawaiian canes under experiment were reaped as second ratoons this season with the rather curious result that, with one exception, they gave better yields per acre in sucrose content as second ratoons of thirteen months growth, than they had given as plant canes seventeen months old. Some newer varieties from Barbados, and some from Louisiana and Mauritius are also under trial at St. Augustine.

SCIENTIFIC PROGRESS IN THE SUGAR INDUSTRY.

The report of the standing committee of the Louisiana Sugar Planters' Association, on this subject, made to the Association on October 11, 1917, is given in full in the *Louisiana Planter* of October 20.

We reproduce below some paragraphs of this report, which show that the Louisiana cane-sugar manufacturers are turning their attention seriously to the utilization of the by-products of the sugar-cane industry, which are referred to in the editorial of the present number of this Journal:—

'The high price of alcohol has made the use of molasses for fermentation purposes quite profitable. This in turn, has reacted upon the price of molasses to such an extent as to interfere seriously with its use in preparing cattle feeds. The high price of potash salts has also resulted in several experimental plants for its recovery from vinesse or distillery slop. From a commercial standpoint potash recovery from cane molasses has probably not passed the experimental state. On the other hand, the alcohol plants have been continually enlarged. The growing importance of industrial alcohol serves again to emphasize the enormous amount of red tape attached to its manufacture. When tax-free alcohol for industrial purposes was first proposed, the idea was that there should be a number of small plants large enough to supply the demands of a small community or perhaps a single corporation. Inspectors and red tape have made this impossible, but the fermentation of various by-products of the cane industry is too important to permit the present condition of affairs to go on unchallenged. It has recently been suggested that molasses be not fermented into alcohol, but into acetic acid, to be used in the manufacture of calcium acetate which in turn would yield acetone. This proposition is practical, as there is no government control of the process. If the commercial problems could be satisfactorily solved it would be particularly applicable to sour juices and the like. The idea would seem to be worth investigation.

'The use of bagasse and molasses in connexion with the making of mixed feeds for cattle is of considerable economic importance. A company is now undertaking to place this process on a commercial basis. Several new propositions for the making of paper from bagasse have been organized in the past year, and these will operate either with bagasse, or with bagasse and wood pulp mixed. They are expected to start active operation during the coming season.'

SPRAYING EXPERIMENT ON CACAO TREES.

A paper by Mr. J. B. Rorer, Mycologist of the Board of Agriculture, Trinidad, published in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Part 3, 1917, describes a spraying experiment made by him in 1916, for the purpose of testing the value of a combination of Bordeaux mixture and nicotine sulphate as a control measure against both the fungus disease, Phytophthora or black rot of pods, and the insect pest, thrips.

For the experiment, a field on an estate at Sangre Grande, which in previous years had been very badly attacked by thrips, was selected. The field contained 1,200 trees, and was divided into three plots of 400 trees each. One plot was sprayed, while the remaining two plots were left unsprayed. The whole field was very even in general appearance, and had always received the same treatment throughout in regard to pruning, draining, forking, etc.

The trees were sprayed three times—August 23, September 14, and October 19. At each spraying 400 gallons of mixture were used, made on the following formula: 5 lb. blue-stone and 5lb. lime to every 50 gallons (American) of water, to which was added 5½ oz. of 'Black Leaf 40'. The mixture was made in the usual way in 50-gallon barrels, and the spraying was done with a spray motor pump No. 2, mounted on a barrel, with two 50-foot leads of hose, and 10-foot bamboo rods. Friend angle nozzles were used. On each occasion six men were employed.

On August 23 the trees were quite well covered with young pods (chirellos), and adult thrips were fairly numerous on the young leaves, especially those on suckers (chupons), and were evidently laying their eggs in the leaf tissue.

The second spraying on September 14 was made chiefly for the purpose of giving the young fruits additional protection from black rot, and to kill any thrips which had hatched out since the first spraying. Between this spraying and the third spraying the trees had made a considerable amount of new growth, and some of the young leaves, especially along the borders of the sprayed plot, were being used by adult thrips for egg-laying, so that the third spraying was made for the purpose of killing these thrips, and also to give the fruit additional protection.

The first picking was made on November 22, and thereafter pickings were made at intervals, varying from three to six weeks, until June 11, after which time there was practically no fruit left on the trees.

Last year both thrips and black rot did a great amount of damage throughout the Sangre Grande district, and a marked difference could be seen between the sprayed and unsprayed trees as early as the middle of November, and from that time on the difference became more and more marked until the end of the crop. The unsprayed trees of the experiment, as well as unsprayed trees on adjacent fields and estates, were very badly attacked by thrips, and were almost defoliated towards the end of the year, which naturally resulted in a distinct loss of crop. On the other hand, the sprayed trees remained in full foliage during the whole time that they were under observation, and produced a very good crop of cacao.

The tabulated results of the pickings from the sprayed and from one of the unsprayed plots of an equal number of trees show that it is advantageous to spray cacao in districts where the phytophthora rot is prevalent, and where the trees are subject to repeated attacks by thrips, for without any additional manuring, drainage, or other cultivation, the 400 sprayed trees yielded 4,371 more pods, and 4,765 more sound pods than the control trees, and the crop was extended to the middle of June. The total number of pods picked from the sprayed plot was 10,921, of which 9,933 were sound, while from the unsprayed the total was 6,550 pods picked, 5,168 of which were sound. Only 9 per cent. of the fruit from the sprayed trees was affected with black rot, while 21 per cent. of that from the control was so affected. The total amount of dried cacao from the sprayed plots was estimated as 1,082 lb. dried cacao from the 400 sprayed trees, while the 400 unsprayed trees gave 72 lb.

The cost of spraying was as follows:—

120 lb. blue-stone at 8c.	$9·60
120 lb. lime	·72
1 gallon 'Black Leaf 40'	10 00
Labour, six men for four days at 40c.	9·60
Total	$29·92

When spraying is done on a large scale the cost of the labour would be relatively less, because six men can spray from 500 to 600 trees per day.

The above figures show that the spraying, even three times, of trees which are well cultivated, pays well; in fact every spraying more than pays for itself, even if the trees are only sprayed once. Each spraying helps to reduce the amount of black cacao and to kill thrips

The above account will doubtless be of interest to cacao growers in other parts of the West Indies, probably especially so in Grenada, where thrips has been causing a definite amount of anxiety.

TOMATO BREEDING IN ST. VINCENT.

The following notes have been sent us for publication, by Mr. S. C. Harland, B.Sc., Assistant Agricultural Superintendent, St. Vincent. They will be read with interest by many tomato growers in the West Indies, some of whom will probably be glad to obtain cuttings of Mr. Harland's F.1 generation of hybrids, with its desirable character of bearing all through the year:—

In the fifth Report of the Board of Commissioners of Agriculture of Porto Rico (issued 1917) there is a preliminary account of hybridization experiments with tomatoes. It is there suggested that it might be possible to combine, by cross-pollination, the disease-resisting qualities of the native varieties with the superior qualities of the introduced kinds.

Some work of this kind has already been carried out in St. Vincent, and it is therefore desirable that some account of the experiments should be given.

The St. Vincent native tomato is characterized chiefly by the following features: it is perennial in nature, and grows so vigorously that a plant may produce branches several feet long; the fruits are small—about 1½ inches in diameter—regularly shaped and smooth, containing a large number of seeds, and so acid to the taste that they are useful only for putting in soups, etc.; the variety is quite unaffected by the disease 'Blossom-end-rot', although it seems to be occasionally attacked by the bacterial disease due to *Bacterium solanacearum*; growth and fruiting apparently take place throughout the year. It has been considered that the St. Vincent native tomato is merely a degenerate strain of some introduced kind, but the writer cannot agree with this theory. The type behaves as a pure strain, and is quite constant in all the characters which have been studied.

Crosses were made between the St. Vincent native and the variety Ponderosa. The latter is a great favourite with West Indian growers, and is distinguished from

the native type by being much less vigorous in growth, by susceptibility to 'Blossom end-rot', and by the large, meaty, well flavoured but usually poorly shaped, ribbed fruits. Ponderosa does not as a rule give a good crop unless planted in late autumn. What is wanted is a tomato which will fruit continuously throughout the year, and bear fruits of a better quality than those of the native.

The F.1 generation. The plants of the first hybrid generation were quite uniform. Planted in March 1917 they made vigorous growth, and produced a large crop. In size the fruits were intermediate between the parents; in shape they took after the native parent, being free from ridges; in quality the fruits could best be described as intermediate. The flavour was not so delicate as that of Ponderosa, nor was the flesh so meaty. The fruits were, however, quite suitable for table use. As the plants grew older, it was apparent that the continuous fruiting habit of the native was behaving as a dominant, and from May 1917 to the present time abundant fruits have been produced. It has to be recorded, however, that the fruits of the F.1 generation were subject to 'Blossom-end-rot', though not to any great extent.

As tomatoes are very easily produced from cuttings, it will be an easy matter to keep the F.1 generation running for as long a period as may be desired.

The F.2 generation. About 300 plants were grown in the second generation The cross was not being made the subject of a genetic study, owing to lack of time, but the following are the chief points noticed:—

(a) In habit the plants ranged from that of Ponderosa to that of native, apparently with no clear line of demarcation.

(b) Every plant was different in the general fruit characters. There was an enormous range of sizes and shapes; both the original parent shapes were reproduced, together with many intermediates. There was a great variety of flavours, and several new and attractive ones were recorded. A most important point is that no fruits as large as those of Ponderosa were found, and none quite so small as those of the native. Most were of, or near the size of, the fruits of the F.1.

(c) During the five months the plants were under observation, many were attacked by 'Blossom-end-rot', but others were apparently immune to this affection. The disease caused by *B. solanacearum* appeared in the plot while the plants were in the fruiting stage, and all the plants finally succumbed. It was noticeable, however, that some plants resisted the disease for a long period, and these are regarded as showing a partial resistance. This observation is in accordance with the experiments of Dr. Nilsson-Ehle, of the Svalöf Plant Breeding Station. He found that when two kinds of wheat were crossed, each of which was susceptible to the attacks of the rust disease, there were produced in the second generation forms which were much more resistant to rust than either parent, and other forms which were more susceptible. Further, some of the forms which were more resistant in the F.2 bred true to the increased resistance in F.3.

With reference to the opinion that rats act as carriers of swine fever, a correspondent of the *Veterinary Record*, September 22, 1917, states that they cannot act as pathological carriers, though possibly they may act as mechanical carriers of the disease, but that great importance need not be attached to the influence of the rat in the spread of swine fever. The diseased pig is and always has been the chief means of its spread.

SCHOOL GARDENS IN JAMAICA.

The following extracts from the report on the Education Department, for the year ended March 31, 1917, submitted to the Governor of Jamaica by the Acting Director of Education, Mr. F. E. Reed, appear worth noting à propos of the stimulated interest in the matters referred to.

Under the head School Gardens, Mr. Reed remarks that one of the Agricultural Instructors writes: 'The abnormal prices for every description of imported foodstuffs gives a unique opportunity to teachers to show to the scholars and to the cultivators of their respective districts the neecessity for not only providing enough food for their own immediate requirements, but for that large and increasingly large number of persons who are continually leaving the rural for urban centres.'

He goes on to report:—

'The Agricultural Instructors have paid numerous visits which have proved of great value to the teachers, and must be of lasting benefit to the pupils.

'The Jamaica Agricultural Society offered prizes during the year for the best kept school gardens, and the competition led to useful work, and encouraged the steady maintenance of the work all through the year.'

Mr. Reed gives several other quotations from the Agricultural Instructors' reports on School Gardens, a few of which are reproduced below. One writes:—

'Some of the gardens have done exceedingly useful work in making trials of special crops in my district, especially with broom corn. There is no lack of interest on the part of the children where even a fair garden is kept, and I much enjoy some of my visits when I meet the pupils. Some of the gardens serve no useful purpose, while the best are invaluable. The main failing is due to lack of consistent effort, especially as regards tidiness. Fences in many gardens are still very inefficient.'

Another remarks:—

The weather conditions during the year were anything but favourable to gardening operations. However, the interest and generally useful character of the work has been well maintained, and, taken in comparison with the work of the previous year, good steady progress has been made, and, in comparison with a few years ago, present conditions are very encouraging. An excellent example has been set in the production of vegetables and other quick-growing crops. There are also instances where the tillage operations are very good, as well as forceful examples of the value of mulch and manure. Nursery beds need more attention.

A third gives the following good advice:—

'More importance is being given to tillage than hitherto. The value of systematic drainage, the use of mulch when and where necessary, the superior results of manuring when properly applied—these are the points which are taken care of by those in charge of the best gardens.

'I have for some years been trying to impress on the teachers the value of experimental work. In many instances this has been fully realized, with the result that the scholars are always deeply interested.

'I regard the educational value of the work as being the most important. The scholars of to-day are to be the agriculturists of the future, and the greatest care should be taken to show the differences between right and wrong methods of cultivation. I cannot too strongly recommend the necessity of school garden work being continuous.'

School Gardens throughout the West Indies have not always been a conspicuous success. The above hints are useful in indicating lines of improvement.

COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending December 1, 1917, is as follows:—

ISLANDS. The market remained quiet throughout the week with only a limited demand, and with Factors unwilling to sell at any concession from prices previously ruling. However, towards the close, with the offerings increasing, some sales were made at a decline of ½c, on a basis of Fine to Fully Fine at 73c., with some Factors refusing to sell, and holding at 73½c. to 74c.

We quote, viz:—

Fine to Fully Fine 73c. to 73½c. = 75c. to 75½c. c.i.f.

GEORGIAS AND FLORIDAS. During the early part of the week the market was dull, as the firm which had been buying largely, presumably on account of Government contracts, had temporarily withdrawn, and there was apparently no other demand.

Nevertheless, the market was firmly held and only some small lots were sold at interior towns at any decline.

Later on, towards the close, the firm buying on account of the Government resumed purchases, admitting of the Factors selling their limited offerings at full prices. This renewal of the demand renders all holders of cotton very firm in their views, and encourages them to look for even higher prices.

We quote, viz:—

Extra Choice to Fancy	74c. = 76c. c.i.f.
Average Extra Choice	74c. = 76c. ,,

The exports from Savannah for the week were, to Northern Mills 1,103 bales, to Southern Mills 46 bales, and from Jacksonville to Northern Mills 2,595 bales.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and sixty-sixth meeting of the Council of the British Cotton Growing Association was held at the Offices, 15 Cross Street, Manchester, on Tuesday, December 4, 1917.

In the absence of the President (The Rt. Hon. The Earl of Derby, K. G.) Mr. Charles Newton occupied the Chair.

WEST AFRICA. The distribution of cotton seed for the new crop has now been completed, and it was reported that 833 tons had been distributed to native growers, as compared with 780 tons for the previous year. It is hoped that the climatic conditions will remain favourable, and that the increased quantity of cotton seed which has been distributed will result in a larger crop during the coming year.

Shipments of cotton seed are now coming forward from West Africa more satisfactorily, and up to date the Association has received about 1,100 tons, and if consignments continue to be made at the present rate, it is anticipated that a fair quantity of last year's seed, which is a very valuable foodstuff, will have been received by the time the new cotton crop is ready for shipment.

A report has been received from the Association's Manager in Northern Nigeria dealing with the increased production of Allen's improved long staple cotton. This is a variety of long stapled American cotton which has been introduced into Northern Nigeria by the Government Agricultural Department, and the quantity grown by the natives under supervision has been as follows: 1913-14 nil; 1914-15, 12 bales; 1915-16, 110 bales; and 1916-17, 461 bales. The production during the past season would have been much greater had the climatic conditions been favourable, and there is every prospect that the cultivation of this class of cotton will increase, as 138 tons of seed have been distributed to planters in certain specified districts where the cotton will not be mixed with the native types. The cotton commands a higher price, and gives a heavier yield than the native varieties, and the price paid by the Association during the past season has been 1¾*d*. per ℔. of seed-cotton on the railway, and 1½*d*. per ℔. at out-stations.

The purchases of cotton in Lagos to November 30 amounted to 7,807 bales, as compared with 9,282 bales for the same period of last year, and 6,121 bales for 1915.

The purchases in Northern Nigeria to October 31 were 3,814 bales, as compared with 10,624 bales for the same period of last year, and 773 bales for 1915.

ARRANGEMENTS FOR DEALING WITH THE 1917-18 COTTON CROP. It was reported that in view of the difficulties of shipping, the Government propose to offer to buy the Uganda cotton crop through the agency of the different firms engaged in buying and ginning cotton in Uganda. The Government have also offered to buy the West Indian Sea Island cotton crop at the port of shipment at a fixed price. The Nyasaland cotton crop has now all been marketed, and, although the difficulties of shipping are very acute, it has been decided that for the present there is no necessity for any intervention on the part of the Treasury. With regard to West Africa, the buying of the cotton crop has been left to the Association, as it is considered that the difficulties of shipping may not be so great.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

NEVIS. The Agricultural Instructor, Mr. W. I. Howell, reporting for the month of November 1917, describes reaping operations and preparation work in connexion with the various plots in the Experiment Stations. The following plants, seeds, etc., were distributed from the Botanic Station during the month: onion seed, 127 ℔.; sweet potato cuttings, 1,450; black-eye peas, 30 ℔.; Lima beans, 5 ℔.

The dry weather during the month was very harmful to the cane crop, which was already very poor, and the crop throughout the island is expected to be a very short one. Sugar is being manufactured on some of the estates for the local market, where it fetches a good price. The first picking of cotton in the early fields is almost finished, and the fields are taking on a new growth, but this is not very vigorous in consequence of the dry weather, which has given a very great set-back to the late fields, as boll-dropping occurred to a great extent; hence the returns from this cotton will be much below what was anticipated. On account of the dry weather also, very little planting of provision crops was done during the month. The reaping of sweet potatoes is in progress, and the yam crop will soon be ready. Several small corn mills were imported recently, and were practically all sold to peasants. The rainfall for the month was 2·11 inches; for the year to date, 42·01 inches.

BARBUDA. In his notes on items of interest concerning the Government estate, Barbuda, for the month of November 1917, the Agricultural Instructor, Mr. C. A. Gomez, mentions that the picking of the cotton crop was in full swing during the month, and approximately 12,000 ℔. of seed-cotton

were harvested. The reaping of the first crop, it was anticipated, would not be completed until late in December. Dry weather continued throughout the month, and consequently the late planted cotton fields hold out no great prospect. If the drought continues, the second crop of cotton will be seriously menaced, although the position is not yet hopeless. An active campaign was waged during the month on large hordes of rats, which ravenously attacked cotton fields and were responsible for considerable damage to the mature cotton bolls. Over seventy-five rats were killed by poison in one district alone. Their presence was doubtless due to the scarcity of fruit, etc., in the woods, as a result of the protracted drought.

Some difficulty is being experienced in keeping bay plants alive owing to the scarcity of water for purposes of watering. On this account also it was impossible to attempt any work in the onion nursery, and it is very doubtful if the island will produce an onion crop this season.

The young stock received careful inspection during the month, and a few bad outbreaks of tick infestation amongst the horses were promptly attended to. The growth of the young stock received a set-back on account of the scarcity of fresh fodder.

Dry weather was experienced in all districts of the island. Vegetation is parched and agricultural activities have become impracticable. Rain fell on three days only during the month, when the total precipitation measured 1·85 inches, making the total rainfall for the year to date, 35·10 inches.

AGRICULTURE IN BARBADOS.

The weather for the month of December has been exceptional in every way. Up to the 22nd day of the month, with the exception of the rain which fell on the 18th instant over a very limited area of the island, there was a continuation of the drought which began early in November. Since the 23rd instant there has been an abnormal rainfall for this time of the year. In some districts 12 inches is the record for three days, the 23rd, 24th, and 25th instant, while the lowest we have heard of is 2¼ inches. Literal rainstorms visited the island on these days.

We need hardly say how very acceptable the change in the weather has been. It has considerably relaxed the tension of the whole community, both in respect to the crops which are approaching maturity, and to those which have been recently planted.

The following is the rainfall for the years 1915, 1916, 1917, on two estates, one in the centre of the island, and the other in the south:—

	1915.	1916.	1917.
Centre of island	79·31 inches	93·80 inches	84·73
South „	51·29 „	55·62 „	50·95

It will be seen that the total rainfall for 1917 compares well with that of 1915, and yet the crop of 1918, now about to be reaped, will fall far below the standard of that of 1916. This is accounted for by the fact that the period of growth in 1917 was a period of drought, whereas the heaviest rains in 1915 fell in the latter part of the year, when most beneficial.

The last quarter of the year is a very important one, and any irregularity of rainfall at that time not only handicaps the new crop by a poor start, but it also considerably reduces the vigour and quality of the crop then approaching maturity. The crop to be reaped next year had a very poor start, and at its journey's end it has experienced an unusual and unexpected drought. It may be that the recent rains, followed by a favourable January and February, will reduce the anticipated shortage. We hope so.

We are glad to be able to state that the tillage for the new cane crop is almost completed. Everywhere the fields present a satisfactory appearance. It is due to this fact that the late rains, heavy as they were, did not cause a severe wash.

The manuring of the young crop still remains a difficulty for the planters. Numerous pens are being rapidly forced, but the quality of this manure cannot be up to mark. A few weeks of the new year must elapse before these pens will be ready, and doubtless some estates, after starting their crops, will have to cease reaping operations for a short time in order to distribute manure.

With the continuance of favourable weather, the cane crop now being planted should have a much better start than that planted at this time last year, in spite of the fact that supplying on a large scale has been necessary.

Nothing more beneficial could have happened for the old cane crop than the downpours already mentioned in this report. Not only will the growth of the canes be revived, but there will be considerable improvement in the juice.

The following totals, compiled from the returns of the various vacuum-pan factories, show the amount of crystallized sugar made in 1916 and 1917 in the island. In the former year 41,104 tons were made, and in the latter 35,895 tons.

It will be seen that the output of the factories this year is less by 5,209 tons than last year. This decrease is due to two causes: (1) the lighter crop produced this year, (2) the more remunerative price of syrup.

We are rapidly approaching the time when the open-tayche system will have disappeared, perhaps even in the manufacture of syrup.

As many as twenty-two estates have changed hands during this year, fetching very high prices in many instances.

The yam crop, though not an abundant one, has been better than was generally anticipated. It is being disposed of at $1·20 per 100 ℔; by retail at 5 ℔. for 10c. The prices at this time last year were $1·00 per 100 ℔., and 8 ℔. for 10c.

Peas and beans were very plentiful early in December, but at Christmas time the supply was not so abundant, and the price gradually rose from 2c. to 4c. per pint. (*Agricultural Reporter*, December 29, 1917.)

AMERICAN CORN CAKES.

The following recipes, contributed by a correspondent to the *Field*, September 29, 1917, may very likely be usefu to housekeepers in the West Indies, in these days of substitutes for wheat flour:—

Thin Cake. One beaten egg, quarter cup sugar, one tablespoonful melted butter or lard, one cup yellow corn meal, one cup flour, half teaspoonful salt, two teaspoons (rounded) baking powder, one cup milk. Bake in greased pan about twenty minutes.

Sponge Corn Cake. One cup flour, half cup corn meal, half teaspoon salt, half teaspoon soda, one-third cup sugar, yolks of two eggs, white of one egg, one tablespoon butter (melted), one cup sour milk. Bake in shallow round pan or in brick-loaf pan.

Indian Bannock. One cup corn meal, one teaspoon sugar, one teaspoonful salt, one pint boiling milk. When cold add two eggs, beaten separately. Bake in a shallow ea then dish in a very hot oven, and serve in the dish like a pudding.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

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Entomologists	H. A. Ballou, M.Sc.† J. C. Hutson, B.A., Ph.D.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial is concerned with the outlook in the future for the sugar-cane industry of the smaller West Indian islands.

A continuation of the subject of the production of light in certain animals is given under Insect Notes on page 10.

The question of the dissemination of parasitic fungi is dealt with on page 14, under the head of Plant Diseases.

Articles referring to the local shortage of foodstuffs will be found on page 15.

Professor E. B. Copeland.

It is announced in the *Philippine Agriculturist and Forester*, September 1917, that Professor Edwin Bingham Copeland, Ph. D., has retired from his position as Dean of the Agricultural College and Professor of Plant Physiology, which office he held from 1909. His retirement is a great loss to the College, for his work has been of the soundest in a wide range of subjects. His book on the coco-nut will long remain a leading authority on the subject.

Dr. Copeland has given the keenest study to the problems of agriculture in the Philippines, and is probably the best authority on the agricultural conditions of those islands. He placed great emphasis on the necessity for right principles in agricultural practice, for he took the view-point not only of a scientist, but also that of a practical agriculturist.

The Ministry of Munitions and Agricultural Machinery.

The following has been received from The Special Intelligence Branch of the Ministry of Munitions with a request for its publication—

'With a view to removing possible misunderstanding of the functions of the Agricultural Machinery Department of the Ministry of Munitions as regards the supply of agricultural machinery, implements, fuel, and accessories, it is to be noted that these functions are confined solely to the carrying out of Government orders for such material received from the Boards of Agriculture for England, Scotland, and Ireland, the issuing of permits to manufacturers, the control of imports and exports; and to giving general assistance to manufacturers in the execution of their orders, whether Government or private.

'The supply of the above-mentioned commodities to the consumer, in so far as it is undertaken by the Government, is in the hands of the Food Production Department of the Board of Agriculture, to whom all communications on the subject should be addressed.'

Zapupe Fibre Plant.

Some years ago, as was noticed in the *Agricultural News*, Vol. VII, No. 156, considerable attention was attracted to the planting and cultivation of Zapupe (*Agave Deweyana*), which resembles sisal hemp (*A. sisalana*) somewhat closely, allowing for the slightly narrower leaves with the prickles on the edges. By 1910 several companies had been formed for its cultivation in addition to the planting done by private individuals in Mexico. In 1913, however, it was reported that the cultivation had ceased. This seems to have resulted from the superior value realized by sisal hemp when compared with Zapupe fibre. The *Bulletin of the Royal Botanic Gardens*, Kew, No. 6, 1917, in a note on this plant, says that it would seem to be advisable for those colonies where the conditions are suitable for Agave cultivation to confine their attention to the better-known sisal hemp, over which, notwithstanding early recommendations, Zapupe apparently possesses no advantage.

Application of Science to Agriculture.

The British Conjoint Board of Scientific Societies, in reporting on the aim, objects, and results of the first year's work, 1916-17, devotes considerable space to the work of the sub committee on the application of science to agriculture. This sub-committee was constituted 'to inquire into and report upon the work at present in progress on the application of science to agriculture, and to make such recommendations as they think fit with a view to promoting the application of engineering to this subject.' The sub-committee reports, amongst other matters, that it believes that a great future awaits the development of electrical applications to agriculture. While on the one hand, in Germany enormous developments have taken place in agricultural districts, and farmers have increasingly utilized electric power, on the other hand, in England, unhappily no applications of electricity to agricultural purposes beyond those within the power of stationary motors have been made. The sub-committee believes that a matter which requires practical experiment and proof is the application of electricity to ploughing and cultivation, reaping and binding, etc. An electrically propelled plough or other agricultural machine would be both simpler in construction, and easier to handle, inspect, and repair than an oil-driven machine.

As an outcome of these recommendations of the sub-committee, the Conjoint Board passed a unanimous resolution on October 10, 1917, as follows:—

'The Conjoint Board recommend that the Board of Agriculture be asked to grant the necessary funds for designing, constructing, and testing practically an electrical tractor and certain other agricultural machines, and to appoint the agricultural sub-committee, or some of its members, as an executive committee to superintend the designing, building, and testing of such plant, and to prepare a report thereon.'

Cross-Pollination of the Mango.

Interesting work in this direction is being undertaken by the officers of the Hawaii Agricultural Experiment Station, according to the report for 1916.

The first phase of the work was the determination of a suitable technique for the pollination of the mango; and the second, the origination, if possible, of new varieties combining desirable characters now found in different varieties, as, for example, the rich colouring of one with the flavour and texture of another.

On the mango there may be several hundred flowers in a single cluster, which is only able, however, to mature a few fruits. In cross-pollinating, therefore, it is necessary to select a few of the best flowers, and to cut out the others to prevent their setting fruit. This makes it possible to segregate the selected flowers from chance fertilization by covering the cluster with a paper bag. Frequently the best flowers are found on the very short branches of the flower-cluster near the outer end of the central stem. When such is the case, the flowers are removed from the larger side branches, without cutting off the side branches themselves, which might cause the whole cluster to fail. The flowers at the end of the cluster are not disturbed. In carrying on this pollination work the flowers are prepared the day before transfer of pollen is made. The flowers are emasculated, and any others that might pollinate them are removed; the whole cluster is then covered with a large paper bag which is removed the next day for pollination, and is replaced immediately. Later flowers on the cluster may be operated upon in the same manner.

Bougainvillaea Seedlings.

With reference to Bougainvillaea hybrids noticed in the issue of this Journal for November 3, 1917, in a letter, dated December 14, 1917, Mr. A. J. Brooks, Agricultural Superintendent, St. Lucia, says that he has successfully raised a plant from the seed obtained by Dr. G. V. Perez by crossing *B. lateritia* and *B. glabra*.

This seedling was unfortunately eaten down when only an inch in height, and remained dormant, with only half an inch of bare green stem, for nearly seven months. By keeping it under a glass bell-jar, and treating it with minute doses of sulphate of ammonia every two weeks throughout the dormant period, the reward has been obtained of having two strong shoots given off from the roots, and it is now making satisfactory progress, though it has not yet flowered.

It will be interesting to get further details when the flowers appear. Mr. Brooks's experience bears out Dr. Perez's observations on the great vitality and reproductive power of the roots of Bougainvillaea.

Mr. W. N. Sands, Agricultural Superintendent, St. Vincent, also records that he has successfully raised plants from root-cuttings of the brick-red Bougainvillaea, as recommended by Dr. Perez. This is worth noting, as the variety in question is not readily propagated by means of stem-cuttings.

Botany and the Living Plant.

In an article published in the *New Phytologist*, November 14, 1917, on the influence of aeration of the nutrient solution in water culture experiments, the authors, Walter Stiles and Ingvar Jorgensen point out the need for a synthesis of the science of botany. They say:—

'Our whole outlook on the physiology of the plant, resulting as it does from incomplete researches on isolated organs, and imperfect generalizations derived therefrom, fails to realize the plant as a unit, or to consider it as a whole. Thus the law of the minimum, and the special case of it called the principle of limiting factors, are not of general application to the activity of the plant as a whole, on account of the interaction of factors and the processes dependent on them. We are still waiting for the more exact statement which shall properly express the law of physiological relations; in other words, we are still waiting for a more satisfactory primary survey of the life of the plant. We are waiting, in fact, for that science of botany which will embody physiology, ecology, and agriculture, and make it the science of the living plant as a whole, having as its basis an elementary analysis of the plant's activities in relation to environmental and hereditary factors.'

INSECT NOTES.

THE PRODUCTION OF LIGHT IN CERTAIN ANIMALS.

In the first part of the article which appeared in the last number under this title, mention was made of some of the animals which are capable of light production, and a short account was given of the habits of some of the so-called 'fire-flies' or 'glow-worms' belonging to the beetle family Lampyridae, occurring in Europe and America. Before proceeding to an account of the recent investigations as to the source of light in certain luminous animals, it may be of interest to mention some of the luminous insects in other parts of the world.

Lefroy, in 'Indian Insects' gives an account of some larval or immature fire-flies belonging to the family Lampyridae which abound in moist localities of the forest areas in India. The luminous patches are on the under side of the hinder part of the body, as is the case in the adults of European and American Lampyridae. Lefroy says: 'This luminosity is very striking, a bright greenish white light being emitted. The light is evidently under the control of the insect and can be quickly produced, though on the cessation of stimulus it fades only slowly. . . . These insects are nocturnal, are dependent upon moist conditions, and feed upon snails. A large specimen required at least six small snails daily, and with sufficient moisture and enough snails throve in captivity. The luminosity is not used in feeding; the insect seizes a snail, curls over on its back with the snail held in its legs, and slowly devours the muscular part, leaving the alimentary canal. This has been observed frequently, and the luminous organ is not functional.'

Lampyrid beetles belonging to the genera *Luciola* and *Diaphanes* are stated to be the commonest light-producing species in India, but it is not known whether these are the adult forms of the larvae mentioned above. Lefroy has observed that in these beetles the males have a larger luminous area than the females, and are extremely bright and vivid in some cases.

We now come to the family Elateridae or click-beetles, one genus of which, *Pyrophorus*, includes some of the most brilliant luminous insects in existence. As mentioned in the first part of the article, the distribution of these beetles is confined, so far as is known, to the tropics of America and the West Indies. Various species of these beetles are quite common in some of these islands for a few weeks during the summer, but very little is known about their habits. A Porto Rican species, *P. luminosus*, is known to be beneficial, as the larva feeds on white grubs or hard-back grubs in the sugar-cane fields. These 'fire-flies' show a great diversity in the position of the luminous organs at different stages in the life of the insect. It is stated by Sharp that the young larva of *P. noctilucus* has a luminous area at the junction of the head and thorax, while the older larva has several luminous points along the sides of the body. The adults of some species of *Pyrophorus* have a prominent eye-like lamp on each side of the dorsal or upper surface of the thorax, and a third luminous area on the ventral or under side of the body at the junction of the thorax and abdomen.

Having touched upon the distribution and habits of some of the luminous animals, I will now give a short account of the structure of the luminous organs of certain typical insects as worked out by some investigators, and of the researches on th origin of the light produced. The whole subject is somewhat complicated and technical, and can only be dealt with here as simply and briefly as possible.

Our knowledge of the structure of the luminous organs of insects dates back some fifty years or so to the work of Schultze, who worked on a species of *Lampyris*, one of the European 'glow-worms'. This investigator found that the light-producing organ, situated in this insect near the extremity of the abdomen, consists of two layers, an external layer which is luminous, and an internal layer which is non-luminous. These two layers are of about equal thickness, are composed of different types of cells, and are closely associated with each other. They are supplied with tracheae, or air-tubes, and nerves similar to those in other parts of the body, which branch throughout the luminous organ between the cells.

The luminous organ of *Pyrophorus* was studied by Heinemann, who found that it was essentially similar in structure to that of *Lampyris*, but the chemical composition was somewhat different. He concluded that the light is the result of a process of oxidation.

The first important contribution to the study of the physiology of the light-producing organs of luminous animals was made by Dubois in France some thirty years ago, and the subject has been further investigated within recent years by E. N. Harvey in the United States, and by Dubois. The researches of Dubois and Harvey have shown that in three different groups of animals, namely fire-flies, ostracod crustacea, and molluscs, there are two distinct chemical substances in addition to water and oxygen which are necessary for the production of light. It is considered that one of these substances is the source of the light, and that the other substance assists in producing the light. These two investigators as will be shown, differ in their theories as to which of the two substances is the actual source of light. (*Science, N. S.*, Vol. XLIV, Nos. 1128, 1140, 1184.)

These two substances were termed *luciferin* and *luciferase* by Dubois, who was the first to discover them in 1884 in the West Indian 'cucullo' *Pyrophorus noctilucus*. A few years later he also found them in the luminous mollusc, *Pholas dactylus*. In the course of his researches he found that luciferin is not destroyed by heat, is capable of oxidation with light production, and can be prepared by extracting the luminous cells with hot water, which destroys the luciferase and not the luciferin. Dubois also found that luciferase has the properties of an enzyme, and is capable of accelerating the oxidation of the luciferin, and can be prepared by allowing an extract of luminous cells to stand until the light disappears. The luciferin is completely oxidized and used up, while the luciferase remains. Dubois made extracts of each of these two substances separately in solution by the above processes, and then was able to obtain light by mixing the solutions of luciferin and luciferase in the presence of oxygen. He concluded therefore that luciferin is the source of the light, and that luciferase acclerates the process of oxidation.

The recent researches of Harvey have led him to arrive at quite different conclusions from those formed by Dubois. Harvey has worked with a number of luminous animals, including fire-flies of both families, and ostracod crustacea,

He has found that the crustacean, *Cypridina*, and the fire-fly *Luciola* both contain bodies similar to luciferin and luciferase, but that the production of light in these forms differs from that described by Dubois for *Pholas*.

In the case of *Cypridina* and *Luciola*, Harvey has found in the first place that the luciferase of Dubois occurs only in the luminous cells, and the luciferin is widely distributed in the non-luminous forms. Secondly, he has been able to oxidize luciferin with light production by the use of certain oxidizing agents; and thirdly, *Cypridina* luciferase will give light with certain substances, some of which could not possibly be oxidized.

Harvey therefore comes to the conclusion that it is the luciferase of Dubois which is the source of the light, and not the luciferin. He concludes that luciferin merely assists in the production of light from luciferase. He therefore proposes to change the names of these two substances, giving luciferase the name of *photogenin* or light producer, and calling luciferin by the name of *photophelein* or light assister.

Harvey gives a simple experiment to show which of these two substances is the source of the light in certain luminous insects. It may be remembered that in the first part of this article (see last issue) mention was made of the fact that the two common fire-flies of the Eastern United States produce light of different colours, *Photinus* giving off an orange light, while *Photuris* emits a greenish yellow light. This difference in colour has been shown by Coblentz to be genuine, since the spectrum of *Photinus* extends further into the red than that of *Photuris*.

The two light-producing substances can be prepared from each of the two species, and Harvey found that the photogenin (luciferase) of *Photinus* mixed with its own photophelein (luciferin) gives an orange light, while the photogenin of *Photuris*, mixed with its own photophelein gives a greenish yellow light. He found that it was possible to 'intercross' the light-producing substances of the two species, so that the photogenin of *Photinus* gives light with the photophelein of *Photuris*, and vice versa.

Now if the source of light is photophelein (luciferin), as Dubois considers, then the light produced by *Photinus* (photophelein 'crossed' with *Photuris* photogenin) should be orange, the colour characteristic of *Photinus*, which supplied the photophelein. Harvey found, however, that the light from the 'cross' is greenish yellow, and conversely the light from a mixture of *Photinus* photogenin (luciferase) and *Photuris* photophelein (luciferin) is orange. In each case it will be noticed that the colour of the light in these 'crosses' is that characteristic of the fire-fly supplying photogenin (luciferase). The photogenin, Harvey concludes, must be the oxidizable substance, and the source of the light.

This subject may be taken up again at some future date, and something further said about the chemical nature of these two substances, and the way in which they react on one another.

J.C.H.

DEVELOPMENT OF BRITISH HONDURAS.

British Honduras is one of the tropical British American colonies that is capable of considerable development. An interesting paper on this colony appeared in the *Geographical Journal*, September 1917. The writer, Brigadier-General Sir Eric Swayne, K.C.M.G., C.B., lately the Governor of the colony, points out that British Honduras is nearly equal in area to all the British West Indian islands together, but that its population of only something over 41,000 is fewer than five people per square mile. Large tracts of the interior have hardly been explored as yet, and its resources have not been at all adequately estimated.

The colony had for its beginning a small crew of shipwrecked British sailors in the year 1638. These settled down to cut and export logwood, the profits on which soon attracted new settlers. After many vicissitudes owing to Spanish attacks, the colony was left definitely in the hands of the British at the end of the 18th century.

The wood-cutting industry still continued to be the chief interest, and even when the price of logwood fell from £100 per ton to £8, so that it ceased to be profitable, the forests of mahogany provided a remunerative product for the wood-cutter. This has militated very seriously against agricultural pursuits, as the mahogany cutter hated to exchange his free forest life for the more settled life of agriculture. The greatest drawback to agriculture therefore in British Honduras, even in its more populous districts, has been the want of a steady labour supply.

Sir Eric Swayne rightly considers that in the development of agricultural interests lies the future of the colony to a very large extent, and he points out that most tropical crops are eminently suited to its climatic and soil conditions.

Efforts are being made to stimulate and encourage more interest in agriculture, as the report on the Botanic Station for the year 1916, recently received at this Office, clearly shows. In this report, Mr. E. J. F. Campbell, Superintendent of the Botanic Station, begins by emphasizing the view taken by Sir Eric Swayne, that the most serious drawback to the agricultural development of the colony is the scarcity of labour, largely due to the superior attraction of wood-cutting.

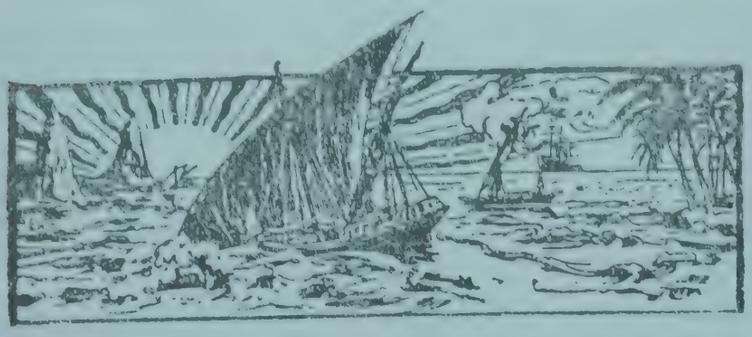
The coco-nut industry seems to hold out great promise of future importance in British Honduras, being well adapted to local conditions. It is hoped that, as there are large tracts of land suitable for coco-nut cultivation not utilized at present, coco-nut plantations will be considerably extended in the near future. The experiment plot under coco-nuts at the Botanic Station is devoted to the demonstration of proper methods of planting and treatment. The system of drainage of the land at the Botanic Station has attracted a good deal of attention, and it is noted that several coco nut planters have adopted a system of drainage for the purpose of improving their lands, with noticeably good results. Another important crop which is capable of improvement and extension is bananas. It seems however that the exportation of this fruit has considerably decreased, owing possibly to crude methods of cultivating the crop.

Mr. Campbell thinks that there are thousands of acres of land in the colony eminently suited to the production of rice. Practically no rice however is grown at present. This also seems to be an industry capable of great development.

Among minor industries, that of the collection of chicle gum, the produce of a species of achras very similar to the well-known sapodilla, has recently been carried out with considerable profit.

Mr. Campbell thinks that among other tropical agricultural products, maize, coffee, and Para rubber, could be largely and profitably cultivated in the colony, although at present no attention is being paid to them.

Amongst valuable plants introduced into the Botanic Station at Belize we notice the Brazil nut (*Bertholletia excelsa*), and the rare palm (*Lodoicea Sechellarum*), known as coco-de-mer or double coco-nut, from the Seychelles Islands, two specimens of which are now growing well in the grounds.



GLEANINGS.

The Governor of Barbados, by a Proclamation dated December 20, 1917, has ordered that no yams and no eddoes shall be exported from the island. A similar prohibition has been extended to sweet potatoes by a Proclamation dated December 27, 1917.

The Department of Agriculture, Mauritius, is engaged in careful soil surveys of the island. Copies of these surveys containing the analyses of various soils, have been forwarded to the Imperial Commissioner of Agriculture for the West Indies. A very useful feature is the statement of the analytical methods pursued both as regards physical and chemical analysis.

The Board of Trade Journal, November 29, 1917, states that the Ministry of Food has issued an order prohibiting the use by brewers of any saccharine substance other than solid glucose, or other produce of low-grade cane sugar polarizing not over 89°, and from which not less than 40 per cent. of its weight has already been extracted in the form of sugar or syrup.

The *Louisiana Planter*, October 20, 1917, praises highly the seedling L. 511, raised at the Audubon Experimental Station. It is stated that in the last crop it has proved its superiority over the two standard varieties Louisiana Purple and D.74, especially in sucrose content. It is considered that, on an average, 15 tons of this cane will make as much sugar as 20 tons of D. 74

Some attention has been drawn to the possible extension of the cultivation of the castor oil plant in Trinidad, on account of the demand for the oil chiefly for lubricating purposes. This is shown by a circular published by the Department of Agriculture of that island offering to supply seed for sowing at 5c. per lb., and drawing attention to the methods of cultivation and reaping.

The reproach that England is almost the only important country in which there are no adequate regulations with the object of preventing the importation of weed seeds, and of providing pure seeds nor any official seed-testing station, is about to be removed, as it is announced that an official seed-testing station for England and Wales is being organized at the Food Production Department. (*Nature*, November 8, 1917.)

Exports of coffee from Martinique appear to decline year by year, although in 1916 the decrease was perhaps due to want of transport facilities. Only 35 quintals of coffee were exported in 1916, as compared with 93 quintals exported in 1915. In the early part of 1917 however, exports of coffee were 30 quintals more than in the corresponding period of 1916. (Documentary Leaflets of the International Institute of Agriculture, Rome, October 18, 1917.)

The editorial notes of the *Colonial Journal*, October 1917, point out that Gold Coast cacao is of comparatively poor quality, but that the production is enormous, and the quantity seems to be regarded as a good compensation for quality under the agricultural conditions prevailing in that colony. The native does not keep his plantation in good order, because he can generally get land for a new plantation when he wants it. The native farmers periodically abandon pest-ridden cacao orchards.

Mr. W. G. Freeman, Acting Director of Agriculture, Trinidad, has notified the Agricultural Society of that colony that the Government has recently opened a depot in Port-of-Spain for the purchase and sale of locally grown foodstuffs. The main object of the depot is to help those who have responded to the call for the increased production of foodstuffs to dispose of their produce, and to obtain good prices for it. (*Proceedings of the Agricultural Society of Trinidad and Tobago*, November 1917.)

The Cook Islands may be called a tropical province of New Zealand, as can be seen from a report of their exports commented on in *The Board of Trade Journal*, November 8, 1917. The export of copra from these islands during 1916 was 1,120 tons, valued at £28,000, and it is estimated that the 1917 coco-nut harvest will exceed that of 1916. During 1916, 94,000 cases of oranges, valued at £16 000, 43,000 cases of bananas, valued at £12,000, and 36,000 cases of tomatoes, valued at £5,000, were shipped to New Zealand. The new season's crop of oranges is estimated at 200,000 cases.

A considerable amount of attention has been given in recent years to the recovery of wax from the waste produced in the extraction of sugar from the sugar-cane, and this industry has now been started on a small scale in Natal. Samples of the first consignment of Natal sugar-cane wax shipped to this country [England] have been examined at the Imperial Institute, and found to be of good quality. Sugar cane wax is now becoming better known on the market, and could be used as a substitute for Carnauba wax in the manufacture of gramaphone records, polishes, etc. (*The Board of Trade Journal*, November 2, 1917.)

The part of the inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture, issued October 30, 1917, recently received at this Office, has an interesting note on a hybrid cane, the result of a cross between the sugar-cane (*Saccharum officinarum*) and a species with little sugar content (*Saccharum ciliare*). This hybrid was produced by the pollination of the flower of a seedling variety of the cultivated sugar-cane with the pollen of the wild species. Although of no commercial value, the hybrid is interesting from a botanical point of view.

THE EXTENSION OF LIME CULTIVATION.

The cultivation of the lime tree, which for some time past only received attention in the smaller West Indian islands, is now being extended to several other British colonies. In British Guiana, for instance, in the last few years a considerable area has been put under this crop. The Government Factory for the manufacture of lime products at Onderneeming, the opening of which was commented on in the *Agricultural News*, Vol. XIV, No. 374, has shown very satisfactory results on the first two years' working. In Trinidad also the cultivation of the lime tree is being much extended.

A report in the *Bulletin of the Imperial Institute*, April-June 1917, deals with the prospect of a paying business in this crop in Nigeria. The variety of lime is the same as that grown in the West Indies and Demerara—viz. *Citrus acida*. The lime tree occurs in most parts of British West Africa, and in some places has become naturalized. The fruits yield a supply of juice which is consumed locally, but up to the present, export trade is practically non-existent.

The lime tree grows well, and is fairly abundant in some parts of Nigeria, and an investigation as to the possibility of developing trade in the fruits and their products has been undertaken by the Government Chemist at Lagos, who forwarded specimens of limes, citrate of lime, and lime oil to the Imperial Institute for examination. The Imperial Institute reports that the fruits are smaller than Dominica limes, but yield juice equally rich in citric acid. The limes are of good quality, but reports from firms of importers in London, who were consulted on the matter, show that the market for fresh limes in Great Britain is very limited, and the demand not sufficient to warrant the fruit being grown extensively in Nigeria for the purpose of export to British markets

With regard to distilled oil of limes, it is reported that on account of its method of preparation the oil is not quite comparable with the distilled oil of limes of commerce. A firm of brokers in London, however, regarded the oil as nominally worth from 7*s.* 6*d.* to 8*s.* per lb. in July 1916.

The odour of the oil was satisfactory, the colour pale yellow. As regards the sample of citrate of lime presented for examination, which consisted of a fine white powder with a slight cream tint, chemical examination at the Imperial Institute showed it to be of satisfactory composition. Samples of the material were submitted to firms of chemical manufacturers, who reported that it represented a high grade citrate of lime, and that material of similar quality would be readily saleable in the United Kingdom at good prices.

When it is considered what large areas at present uncultivated, and well adapted to the cultivation of the lime tree exist both in British Guiana and the West African colonies, it seems more than likely that in the near future the trade in lime products will receive much greater attention in colonies outside of the West Indies, and that the West Indian islands at present growing this crop will have to make every effort to compete with their larger rivals.

Sicily has long been the chief producer of citrate of lime, and consequently the price of this article has largely depended upon the Sicilian output. The *Perfumery and Essential Oil Record*, November 1917, states that the unsatisfactory condition of the industry in Sicily and Calabria was causing considerable anxiety to producers. The condition was such that a royal decree has been issued by the Italian Government to control the production of both lemon oil and citrate of lime during the war, and for three months after its conclusion. This decree fixes the quantity to be produced and the time of delivery for citrate factories, and also establishes the price which factories shall pay the lemon growers for fruits. In view of the Sicilian situation, one firm to whom the sample of citrate of lime from Nigeria was submitted by the Imperial Institute, stated that they were interested in the question of assisting the citric acid industry in the British Empire, as at present manufacturers are chiefly dependent on Sicily for their raw material. This position is considered unsatisfactory, and the firm stated that the development of fresh sources of supply would, they were sure, be welcomed by all the manufacturers concerned.

Having regard to the foregoing it would not seem that there is danger, at present at least, of any overstocking of the market with citrate of lime or concentrated lime juice

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FOODSTUFFS IN MALAYA.

A report of the proceedings of the first Agricultural Conference held in Malaya in 1917 appears in the *Agricultural Bulletin of the Federated Malay States*, August and September 1917.

Two of the papers read related to food crops and food supplies in the Malay Peninsula. It would seem that those States suffer very much like the West Indian colonies from devoting their attention to some one paying commercial crop, in their case rubber, and neglecting food crops.

Some remarks of the Chairman, Mr. L. Lewton-Brain, Director of Agriculture of the Federated Malay States, who was formerly Mycologist of the Imperial Department of Agriculture for the West Indies, in the discussion which followed the reading of the papers referred to, seem particularly pertinent to the present state of affairs in the West Indies. He pointed out that the subject could be divided into two parts: first, the growing of vegetables by individuals for themselves, and second, the general food supply of the country. Far too few planters grew their own vegetables, or planted fruit trees. It was perfectly easy to do so, but it certainly required personal attention. The question of the general food supply of the country was of great importance not only to the Government, but also to the planting community as large employers of labour which was now dependent for its food on imported supplies. Taking the staple food of the country rice, approximately three times as much was imported into the Federated Malay States annually as was produced. The Government was doing a great deal to increase the food production by small holders, but the cultivation of rubber had made the small holder so prosperous that he was not anxious to undertake the more laborious and less profitable work of growing paddy. Could not more be done on and by estates to increase the production of foodstuffs? In all other countries he had worked in, where there was a resident labour force on estates, the labourers grew most of their own foodstuffs. In Malaya there was practically nothing of the sort done at all, and the estate labourer was entirely dependent on imported food. As the reader of one of the papers had pointed out, there were many kinds of food that could be grown there, and which probably, in course of time, would be grown. It was not, however, a healthy state of affairs that an agricultural community should be content to continue depending on imported foods to such an extent.

PLANT DISEASES.

THE DISSEMINATION OF PARASITIC FUNGI.

In a paper on the dissemination of parasitic fungi and international legislation relating thereto (*Memoirs of the Department of Agriculture in India*, Vol. IX, No. 1) Dr. E. J. Butler, Imperial Mycologist, discusses a subject of very general interest to agriculturists. For the detailed examples with which the discussion is illustrated reference must be made to the original paper; the following summary will show the nature of the conclusions reached.

Fungi depend for their spread upon the transfer of either spores, which in their nature are analogous to the seeds of flowering plants, or of their vegetative part, the mycelium. The former are small and often form a dry dust, and are quite commonly long-lived, resistant bodies. They are thus capable of transmission for long distances in a large variety of ways. Air-currents, streams, and animals of all kinds from insects to man afford obvious agencies for their dispersal.

The mycelium is mainly liable to be transmitted only with the plants or their parts on which it occurs, in some cases on living material only (which may include seeds), in others on dead parts such as wood, stems, or leaves. In a few cases the mycelium of plant parasites may be transmitted in dry or moist soil.

In considering transfers from one place to another when natural barriers—seas, mountain ranges, or regions of widely differing climate—intervene, the natural means are practically reduced to two: winds and migratory animals, (chiefly birds, and in a few cases insects). While these are possible means, consideration of the evidence does not suggest that they have much importance over any but short distances. The positive and negative evidence of the distribution of all the best-known diseases points to the conclusion that their introduction to new countries depends on the interchange of growing plants, of seeds, and perhaps, to a lesser extent, of fruit and vegetables. The agencies most conspicuous in this respect are Departments of Agriculture, Botanic and Experiment Stations, and commercial nurserymen and seed dealers. (The criticism often heard of the activities in this direction of the first- and second-named institutions may be met to some extent by pointing out that as a rule they are the only agents fully aware of the dangers involved and in a position to take the necessary precautions.)

Probably at no period in the history of the world has the movement of plants of economic worth, to and from distant countries, been carried on so extensively as at the present day. The time taken in transit has been continually shortened since the introduction of steam, and whether the parasite is best fitted to travel as spores or as mycelium, few parts of the world are now remote enough to prevent the great majority of the fungi that cause disease from being introduced with their host plants in a living condition.

Diseases, once they are present in a country, can ordinarily make use of the methods of continuous spread which are mostly uncontrollable. There have been attempts in the past, and several are in progress at the present moment, to exterminate newly introduced parasites in various parts of the world. It is doubtful if any have succeeded, while some are known to have failed completely. The action taken to be effective must be such as to keep the disease from getting a footing in the country. For this purpose it is important to know from what part of the world diseases dangerous to the crops of any particular country are likely to come and what diseases exist in each area which could be imported and might prove injurious. In order to be as secure as possible against the introduction of exotic diseases there seems to be no alternative at present but to consider each important economic plant separately, and examine the records of the parasites that attack it in various countries. Difficulties arise from the imperfections of our knowledge regarding even the best-organized countries, and the almost entire absence of information regarding others. There is also the unfortunate circumstance, illustrated by some of the most notorious diseases, that a parasite which is relatively harmless in one country may be extremely destructive in another. No amount of organization will remove this difficulty.

In February 1914 an International Phytopathological Conference was held at Rome and agreed upon a Convention the object of which was to control the inter-state circulation of horticultural produce. The application of the Convention has been largely suspended as a result of the war.

It is proposed to control the interchange of living plants, cuttings, grafts, flowering bulbs and cut flowers with certain exceptions. Each State undertakes to set up a Government service of Phytopathology, the duties of which will be to supervise nurseries and inspect consignments intended for export. No such material will be admitted without a certificate that its sanitary condition is satisfactory, and (where required) that it is free from certain specified diseases. Each adhering country will prepare a list of the diseases against which it wishes to guard itself. Common diseases already widely distributed must not be included, and the diseases mentioned must be those of an epidemic character, very harmful, and easily disseminated by living plants or their parts. The Convention does not apply to seeds or to edible root crops, fruits and vegetables, or field produce. Living plants for scientific study in authorized institutions are also exempted. From non-adhering countries imports may not be accepted unless certified by 'competent official agents.'

Dr. Butler points out that these rules, while representing the maximum of control that could be agreed upon, and presenting numerous difficulties in their application to special circumstances, will fall very far short of ensuring complete security. The stipulation that only very harmful diseases may be listed leaves out of account the variation in virulence already referred to, and for that reason the rules could not have hindered the original transmission of parasites which have turned out to be extremely destructive in fresh countries. The exemptions referred to each leave a large loophole for the introduction of disease. There is however no reason why any particular country that so desires should not further protect itself, and the international machinery once it is established will no doubt quickly be improved upon.

The position of the West Indies with regard to these questions is in many respects a special one. Their agricultural territory is divided by broad channels of the sea into relatively small areas, each concerned with but a small number of staple crops, and the existence in each island of an agricultural department makes it feasible for a close control to be maintained over introductions. But these circumstance, though they make protection possible, do not in themselves ensure it

So far as it can be ensured it depends on the maintenance of an up-to-date service of information, on the restriction of introductions to responsible agencies, and their reduction to the minimum consistent with real requirements, and above all on the vigilance with which the orders made are administered. As regards imports, local regulations have in most cases already gone well beyond the scope of the Convention.

W.N

DRYING VEGETABLES ON A LARGE SCALE.

That locally produced foodstuffs must be reserved for local needs is evidently becoming a truism in these islands. This is shown by Government Proclamations in different islands prohibiting the exportation of such things as corn and potatoes, yams and eddoes, peas and beans.

But the problem is not entirely solved by such a step. With regard to many locally produced foods, there is a difficulty in storing them for any length of time so as to preserve them in a sound and wholesome condition. In several recent issues of this Journal attention has been called to this point, and recommendations as to methods of drying roots and other vegetable products for future use have been put forward, based on experience in other countries.

Especially has attention been drawn to the possibilities of drying and storing sweet potatoes in considerable quantities, as was successfully done in Antigua some years ago by Mr. Spooner, who contributed an account of his successful experiment to this Journal, Vol. XV, No. 402. From that account it may be gathered that the ability to effect this is well within the power of practically every estate manager. We have not received any communication as to whether such drying of potatoes or other roots has been tried. Even however at the risk of appearing prolix, we return to the question, as a shortage of imported foods, if not the absolute cessation of any importation, seems, in view of the present world's situation, not only very possible, but very probable.

In the *Journal of the Department of Agriculture of Victoria*, Australia, October 1917, there is a description given of a kiln evaporator for the production of dried apple rings. This description is extracted from a bulletin issued by the Agricultural Experiment Station of the State College of Washington, U.S.A. This method of drying apples, with perhaps slight modifications seems very suitable for application to sliced sweet potatoes or any other vegetable product. It is claimed for the kiln evaporator that it may be constructed and operated at a lower cost than is necessary for other driers of similar capacity, and that the quality of the product is better and more uniform.

Plans and details of contruction are given in extenso in the article referred to. The smallest plant is a building 20 feet square and two stories high, the lower story, which contains the stoves or heating furnaces, being about 10 or 11 feet high, while the second story, where the fruit is spread on the floor to be dried, is only about 6 or 7 feet high at the eaves. The floor is made of narrow slats laid with an interval of $\frac{1}{4}$ or $\frac{3}{8}$-inch between them, and the product to be dried is spread upon this floor to a uniform depth of 4 to 6 inches. Two lines of pipes conveying the heat from the furnace are carried round the room one or more times at a distance of 2 feet from floor and wall.

Such a kiln will dry a charge of sliced apples, spread 5 or 6 inches deep, in from eighteen to twenty-four hours. The actual daily working capacity for a kiln 20 feet square is from 70 to 100 bushels, according to circumstances.

The cost of such a building will of course vary according to local prices, etc., but a New York firm contracts to erect one of concrete blocks, and to equip it fully with the necessary appliances for $1,450. A noticeable appliance is the bleacher, by means of which the sliced apples are subjected to sulphur fumes, in order to avoid their turning dark in the process of drying.

A plant of such a kind might be of the greatest value in any one of these islands at the present time, for drying all sorts of vegetables and enabling them to be stored for a long time without danger of spoiling.

SHORTAGE OF MEAL.

The shortage of imported foodstuffs, which has been expected in the West Indies, is evidently becoming a fact to be faced. The *Barbados Advocate*, January 9, 1918, states that 'the arrival of a recent steamer from New York without any meal has caused considerable disappointment. Enquiry at one of the principal importers of meal as to the reason for non-importations, developed the fact that there appears to be difficulty in obtaining permits for exportation from the United States Government.

'Of course we ought to be better off than we are in respect of food supplies, as we should have taken better care to grow local foodstuffs.'

The last paragraph is somewhat like crying over spilt milk; but the question is whether anything can at once be done to relieve the situation, which is certainly one not affecting Barbados alone.

We throw out the following suggestion. Let every planter in these islands sow, on the banks between his young plant canes, rounceval or black-eye peas. These ought to bear in six or eight weeks—the quickest food crops to be grown. It is true that in dry weather, which is to be expected at this time of the year, a large return is not likely to be obtained, but unless an absolute drought is experienced, a moderate yield will probably result, if the peas are sown much more closely than is the usual practice in rainy months. The growing of peas in this way is not likely permanently to injure the young cane plants, but will assist in keeping down weeds. In six weeks time there will be some food at least being produced. Supplies of these peas for planting can probably be obtained quickly from St. Vincent and Trinidad.

THE AVOCADO PEAR IN CALIFORNIA.

Santa Barbara County in California has taken up the cultivation of the avocado pear, according to an article in the *Monthly Bulletin of the State Commission of Horticulture*, California, November-December 1917. It appears that the first avocado pears grown in that county were introduced from Mexico in 1870. One of these produced large crops of fruit from which many seedlings were distributed. In 1911, however, seeds of choice varieties were introduced from Honolulu. One of these varieties, known as the White Avocado, seems to have very valuable qualities. An ordinary stock budded with this variety in 1912 produced in less than two years a crop of sixty matured fruit. So prolific is this tree that it is said to bear fruit almost every month in the year.

Another of the latest varieties brought from Honolulu is known as the Nutmeg Avocado, remarkable for the size of its fruit, each fruit weighing from 1½ lb. to 2 lb.

There are said to be no less than seventy-eight distinct varieties of the avocado pear now under experiment in the Santa Barbara county. The experiments are undertaken not only with a view to determining what varieties bear the best fruits both as to flavour and keeping qualities, but also with a view to test the comparative hardiness of varieties, in view of obtaining some which will stand comparatively heavy frosts. Bearing avocado trees are now found in hundreds of the local gardens, and the more they are known the better they are liked, so that it will soon be impossible for any Californian to think, as some now do, that the 'alligator pear' is a kind of wild animal food.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, November 1.

ARROWROOT—5⅞*d.* to 6½*d.*
BALATA—Venezuelan Block, 3/2½; Sheet, 3/9½ to 3/11.
BEESWAX—No quotations.
CACAO—Trinidad, 87/- to 95/-; Grenada, 90/-; Jamaica, no quotations.
COFFEE—Jamaica, 72/.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, 100/- to 110/- per cwt.
LIME JUICE—Raw, 2/6 to 3/.; concentrated, no quotations; Otto of lime (hand-pressed), 16/-.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—No quotations.
RUBBER—Para, fine hard, 3/1; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., November 22.

CACAO—Venezuelan, $11·25 to $11·50 Trinidad, no quotations.
COCO-NUT OIL—$1·30 per gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—7¼c. per lb.
DHAL—No quotations.
ONIONS—$8·00 per 100 lb.
PEAS, SPLIT—$12·00 to $12·50 per bag.
POTATOES—English, $4·50 to $5·00 per 100 lb.
RICE—Yellow, $10·50 to $11·75; White, $9·25 to 9·50 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS. & Co., December 11.

CACAO—Caracas, 12½c. to 13c.; Grenada, 12c. to 12¼c.; Trinidad, 12⅜c. to 13c.; Jamaica, 9c. to 10¼c.
COCO-NUTS—Jamaica selects, $40·00 to $42·00; Trinidad selects, $35·00 to $38·00; culls, $20·00 to $30·00 per M.
COFFEE—Jamaica, 9¼c. to 11c. per lb.
GINGER—16½c. to 21c. per lb.
GOAT SKINS—Jamaica, 80c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 65c. to 70c. per lb.
GRAPE FRUIT—Jamaica, $2·25 to $3·00 per box.
LIMES—$6·50 to $7·00 per brl.
MACE—32c. to 38c. per lb.
NUTMEGS—18½c. to 21c.
ORANGES—$2·50 to $3·00.
PIMENTO—5¾c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 6·70c; Muscovados, 89°, 5·86c.; Molasses, 89°, 5·57c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 30.

ARROWROOT—$8·00 per 100 lb.
CACAO—$11·00 per 100 lb.
COCO-NUTS—$36·00 husked nuts.
HAY—No quotations.
MOLASSES—No quotations.
ONIONS—$12·00.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—$6·75.
RICE—Ballam, $10·00 to $10·80 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, no quotations.

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Peace and Food Scarcity.

THE title of this article may seem strange and strike a jarring note, for the expression peace and plenty has a more familiar ring, and most people appear to feel that food scarcity will somehow automatically cease with the war, and that peace and plenty will be synonymous terms. Such an idea however is demonstrably wrong. If peace were proclaimed to-morrow, the scarcity now existing in food supplies must continue not only for this year, but probably for some time afterwards, because of the world-wide conditions which the war has brought about, and which can only be ameliorated by degrees.

Mr. Prothero, President of the British Board of Agriculture, in a speech to the British Empire Producers' Organization, which was reported in *The Times*, November 9, 1917, uttered a warning to the nation as to the seriousness of the food outlook even if peace were soon made. This speech is so apposite to notions apparently widespread in these West Indian islands, that the reproduction of parts of it in this Journal need no apology. Mr. Prothero said that some of them, perhaps, were inclined to think that the difficulty of the situation would be over, when they heard the joy bells ringing 'peace and plenty.' But the food situation would not be rendered less difficult by the proclamation of peace; on the contrary, the difficulty might even be increased by it. It was quite true that sources of food supply which had been closed to us would be reopened. On the other hand, it was almost certain that the demand for the world's exportable surplus would be very largely increased. A danger not unforeseen had been slowly approaching, and unless it was arrested it would rapidly develop. The productive power of the soil of Europe was failing. It was not merely that large areas under cultivation were now devastated wastes: it was that regions remote from military operations were losing their fertility for want of labour and fertilizers.

After referring to the proverb about peace and plenty much in the terms alluded to above, the speaker went on to say that peace would not bring plenty to us unless we were able at once to return in three important particulars to pre-war conditions. We must have the food for sale on the foreign market; we must have the means with which to buy it; and we must have the means by which to carry it home.

The three conditions referred to by Mr. Prothero as applying to Great Britain equally apply to these

islands. Whether peace is won, or the war prolonged, there will be a shortage of food supplies, we repeat, throughout the world in 1918 and for some considerable period afterwards. This is a certainty of which we are warned, a statement resting upon demonstrated facts, and admitting of no doubt or contravention. In these islands, as in Great Britain, people have been accustomed to import from abroad the food that we could not, or would not, or at all events did not, produce for ourselves. We too have enjoyed the facilities for importation so long that we find it hard to understand that an entirely new situation could arise, which in fact has now arisen. Owing to the conditions referred to above, the European nations at war cannot produce the same quantity of food that they formerly produced, and are forced to look for other markets. It is therefore idle for us in the West Indies to delude ourselves with the idea that the United States and Canada, who are themselves beginning to feel the drain of man-power, can so increase their output of food as not only to supply the pressing needs of their European allies, but also to send to us the amount of food which we have been accustomed to receive from them. We are bound to suffer, and to suffer in proportion that we have been dependent, not only for luxuries, but for food necessities, on imports from abroad.

Turning to the second condition given by Mr. Prothero; in spite of money coming into these West Indies more freely on account of the increased price paid for their productions exported, we shall still have to pay double for everything we import. Assuming therefore that the food was obtainable, shall we have money enough to buy it?.

With regard to the third condition; are we going to find ships to bring sufficient food supplies to us? It must be remembered that every ship used as a food carrier will diminish the tonnage that might be employed in the transport of raw and semi-manufactured materials, on which great manufacturing industries of Europe depend, and that the supply of ships owing to war destruction will be limited.

It would be foolish to prophesy how long the period of scarcity will last after the war. That will depend upon the efforts made to reduce the scarcity. For instance, the moment war ceases, some materials now used for the manufacture of munitions will be available for fertilizers, and the exhausted soil of Europe may recover with astonishing rapidity. Many men liberated from military duty will turn to agricultural pursuits; the machine shops also, at present producing munitions of war, will be enabled to pay attention to the manufacturing of agricultural implements such as tractors, ploughs, and all the various machinery that will doubtless play so large a part in the agriculture of the future. Meanwhile there ought to be no slackening of the efforts to be made in all directions, towards economy in food supply, and towards increasing local production of foodstuffs.

At the conclusion of his speech, Mr. Prothero praised the efforts made in 1917 by the farmers of Great Britain: they had grown more wheat, barley, oats, peas, and potatoes than in 1916, in face of the most tremendous discouragement owing to the weather, want of labour, want of fertilizers, and want of almost all the implements of production. The example of the British farmer may be well held up as a guide to the West Indian planter. It is to be hoped that when they realize the situation our planters, like the farmers in Great Britain, will do all that is humanly possible to lessen the certain scarcity.

Mr. Prothero concluded his speech as follows: 'Peace has its dangers as well as war. The future is dark and difficult but for one thing. We have a unity such as never before, a unity which is the most precious of our national treasures, although we do not seem sometimes to realize it. Will that unity stand the test of hunger? Make what answer you like: I will not answer it: but remember that hunger is inexorable, essentially selfish, implacable, blind, deaf, and pitiless. If we want in time of peace to pass through the difficult period of reconstruction, let us pray "God speed the plough in our native land."'

WAR BREAD.

Bakers Review, December 1917, published in New York, contains several articles with reference to the above subject, extracts from which will doubtless be interesting and useful under existing circumstances. In these troublesome times innovations in many matters are no longer received with surprise, but rather as a matter of course. It is therefore scarcely astonishing to learn that the Food Administration Department of the United States has been for some time considering the advisability of requesting bakers, and possibly housekeepers, to try the experiment of using with their wheat flour a small or moderate percentage of substitutes, so as to reduce the consumption of wheat without causing any noteworthy dissatisfaction among consumers.

From a nutritious point of view, and with regard to calories or food values, most of the kinds of bread experimented with are satisfactory, and even palatable, especially that made with a mixture of corn meal, and their use is to be encouraged to the

greatest possible extent in the present crisis. With the exception of corn bread, which is sometimes eaten in preference to the best white wheaten bread by people used to it, probably no other bread than that from wheat flour will be appreciated by everybody, so that it is hardly probable that any such bread will become universally popular. Nevertheless, every baker should do his best to make as good a special loaf of bread containing the minimum percentage of wheat flour as is possible. All such special bread is not difficult to make in small batches of a few loaves.

It is characteristic of all flours deficient in gluten that the dough becomes more or less sticky, owing to lack of this substance, to which wheat flour owes the peculiar property of forming a spongy dough. For this reason the making of a satisfactory loaf of bread in large quantities from other than pure wheat flour is quite a serious problem, which bakers will have to face.

The review referred to goes on to say that the wheat supply of the United States must be utilized not only to satisfy the needs of that country, but also to feed the population of the allied countries in Europe. For this reason it is necessary to make the American wheat supply go as far as possible, by using some substitute for it. These substitutes are, in the order of their nutritive qualities, corn flour and corn meal, rye flour, oat meal, rice flour, and potato flour, and sweet potatoes. In the West Indies we are practically concerned with only the first and last of these.

Regarding the use of corn flour or corn meal, it can be said that from 15 to 30 per cent. of this can be advantageously used in combination with wheat flour, if the bread is made either with yeast or with baking powder. According to experiments made by *Bakers Review*, the formula and method of making are as follows:—

CORN BREAD RAISED WITH YEAST. Make a sponge from 1½ lb. of strong wheat flour, 1 oz. of yeast, and three-quarters of a quart of water. When the sponge is ready, add ¾-oz. of salt, 1 oz. of sugar, 1 oz. of lard compound, and 1 lb. to 1¼ lb. of fine yellow corn meal. The dough must be very soft, because the corn meal while being baked absorbs a great amount of water. Place this mixture immediately in papered pans, and let it stand until fermentation starts again. Then bake in good heat.

CORN BREAD RAISED WITH BAKING POWDER. *Bakers Review* also experimented with baking powder, and found bread thus prepared preferable to the yeast-raised corn bread. The formula is a very simple one, and usually turns out very good bread, it is reported. Mix together 1½ lb. strong wheat flour, 1½ lb. fine yellow corn meal, 3 oz. baking powder, 1 oz. salt, 1 to 2 oz. sugar, 1 to 2 oz. lard compound. Place, as in the former recipe, in papered pans, and bake in good heat.

Another excellent formula for mixed bread is given as follows: 3 lb. sweet potatoes, ½-lb. corn meal, ½-pint milk, ½-oz. baking powder, ½-oz. salt, 1 oz. lard or other shortening, one egg. Boil the sweet potatoes, peel and wash them, add salt and shortening. Mix in the corn meal, the baking powder and the beaten egg. Pour into a greased pan, and bake in a moderate oven for half-hour.

The use of cotton-seed flour has been suggested as a substitute for a portion of wheat flour by the Food Administration. Experiments in this direction have also been made in St. Vincent with some success. Cotton-seed flour is exceptionally rich in protein, and is used only in proportion of about 1 to 4 with wheat flour or corn meal. The cotton-seed flour is made from the cotton-seed meal of commerce, by a roasting and bolting process, by which process the resins, fibre, and seed-coat particles are removed, thus rendering the meal fit for human consumption.

It would not be advisable to use the ordinary cotton-seed meal in bread, without some special preparation such as is mentioned above.

MARINE PRODUCTS IN THE BAHAMAS.

Colonial Reports—Annual, No. 932, contains the Annual Report for 1916-17 on the Bahamas, transmitted from the Governor of that Colony to the Secretary of State. An interesting portion is the report of the Marine Products Board.

It appears that the sponge trade has had a large revival, proved by the fact that the sales of sponges for the year reached the sum of £113,300, an increase of nearly £14,000 over the largest previous record. It is true that the market has been stimulated by war conditions because of the military restrictions in the Mediterranean, which have seriously interfered with the sponge industry in that sea, so that larger orders have been placed in the Bahama market. It is to be regretted that the supply of certain kinds of finer sponge required for the trade is only limited in the Bahamas, owing to the fact that the fine-sponge fields in those islands are few, limited, and over-reaped. The Board states that there is no room for doubt that artificial culture of sponges is not only feasible, but profitable, and that the probabilities are that it will soon be classed among the regular industries of these waters. It therefore should be carried on extensively by the Board with the object of replenishing depleted sponging grounds. The Board however, at present is only able to demonstrate in a small way, as at Exuma, that sponges can be artificially grown with success in the Bahamas.

During the year reported on, the Board has scattered in the current beds 85,000 shells with sponge cuttings attached. This quantity is by no means sufficient to restore these beds to their former condition. However, by means of a close season, and the scattering of considerably more shells, the Board expects to see this result achieved. Sponge is the chief source of revenue of the colony, but the Board is doubtful if this important industry can be maintained under the present system of practically indiscriminate picking.

Another marine product, which the Board considers as worthy of more attention, is bêche-de-mer. This consists of dried marine animals related to the sea-eggs, and belonging to the genus *Holothuria*. These are very commonly known as sea cucumbers, and occur in considerable numbers throughout the West Indies. Bêche-de mer constitutes an important article of diet amongst the Chinese. In Australia, also, bêche-de mer soup is regarded by connoiseurs as the equal of turtle soup, and is to be found in the menus of the leading clubs and hotels. Even in Paris, bêche-de-mer is served at many restaurants, but the great market for the product is China.

The Board recently obtained from Hong Kong a very fine lot of bêche-de mer prepared for the Chinese market, as an object-lesson of what marketable bêche-de mer should be. Since then experiments have been made, and a number of bêche-de-mer have been cured almost in the same manner as the Chinese samples.

This lot, which has been despatched to Hong Kong, is as near to the Chinese product as they have got. The Board anxiously awaits the verdict of the experts to whom they have been submitted. But, as in other matters, it is impossible to carry on experimental work without scientific assistance.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. The Agricultural Superintendent, Mr. W. N. Sands, in his notes for the month of December 1917, describes reaping operations in connexion with manurial experiment plots in the Experiment Station, and reports increased yields and larger size of the rhizomes from the mulched arrowroot plot. Work in the Botanic Gardens was of a routine nature. Plant distribution included 3 coco-nut plants, and 25 decorative. Regarding staple crops the picking of cotton was continued, and there was little change in the crop outlook to report. The condition of other crops was normal: the cane crop was, however, poor in places. Mention is made of estates visited in connexion with pests and diseases by the Entomologist and Mycologist of the Imperial Department of Agriculture. Both these officers left for Barbados on December 9. The weather during the month was fairly dry: the rainfall recorded both at the Botanic Station and Experiment Station was 4·66 inches.

Attached to this report is one from the Foreman of the Experiment Station, on the condition of crops on the Land Settlement Estates at Belair and Clare-Valley Questelles, during December 1917. At Belair comparatively little cotton is grown, and the cultivation, with three or four exceptions, was very poor. This is attributed to poor soil, and heavy intercropping with sweet potatoes and cassava. The interest of the holders at Belair is chiefly centred on sugar-cane cultivation. This crop, however, was a failure this season, owing to the ravages of pests and diseases, the reduction in some cases from last year's yield being 90 per cent. The variety generally grown is the Bourbon, which is very susceptible to attack by almost any pest or disease. The remedies suggested are, (1) to plant resistant varieties in the place of the Bourbon, (2) the cutting out and destruction of dead hearts in order to kill as many grubs as possible, (3) not to plant Indian corn along with the canes, as this plant is also attacked by the pests, and (4) cultivating and manuring the canes in the best possible manner.

At Clare Valley Questelles cotton is the chief crop grown, and the holdings situated on the side of the hills which were not thickly intercropped by ground provisions, yielded good crops of cotton. On the other hand, the holdings situated in the valley gave poor yields from the following causes: (1) boll-dropping, due to infestation of green bugs living in large numbers on black-eye peas sown throughout the holdings: (2) intense intercropping, and overhead shade by bananas and plantains: (3) mildew, causing boll-dropping in some few cultivations badly situated with respect to not receiving direct sunlight. Cacao plants on some holdings were badly attacked by thrips. Ground provisions, especially cassava and yams, are extensively grown.

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The date fixed this season by Proclamation, for the destruction of old cotton plants is January 31, 1918, and planting is allowed from March 1. Exemptions are being sought for several large areas carrying appreciable second crops, and these will probably be granted, as in the case of two areas last season. The number of small planters applying at the Treasury for licenses to sell cotton has exceeded 1,000, which is a record for this island. Very considerable areas are also grown by peasants on the share system, when no license to sell is required. The growing of cotton on the share system is likely to increase, and people are travelling long distances to secure access to cotton land. The building of a sunken silo on one estate is of interest. The examination of samples from the cotton breeding plot was completed. Samples of oil from the forty one distillations made from the bay plot in 1917 were forwarded to the Government Laboratory at Antigua for examination. The rainfall at Grove Station was 2·72 inches, the total for the year being 68·22 inches. The rainfall in December consisted of light showers only, and rain is much needed.

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The area of cotton planted in Antigua is 519 acres. In addition, 50 acres of cotton are planted in Barbuda. The dry weather experienced during the month has made a considerable difference to the general appearance of the cane crop. Unless good rain is experienced the crop, Mr. Jackson thinks will be 30 per cent. less than that of last year. A combined motor plough and tractor has recently been imported into the island by Messrs. A. J. Camacho & Co. It would seem that this implement will prove of value

Full details in connexion with this will be forwarded to Barbados in a short time.

The lint from cotton selections was examined during the month. One plot at Dawcolts was allotted, and two applications for plots were received. During the month 3,508 lb. of seed-cotton were purchased by the Antigua Cotton Growers' Association. Only 2·09 inches of rain fell during the month. The rainfall for the year was 39·15 inches, as against 65·03 inches for last year. On the whole, the weather during the year, from an agricultural point of view, has been unfavourable.

Appended to the above is a short report on the work of agricultural instruction during the month of December 1917. From this it appears that the yields obtained from the cotton crop of the peasants are far below what was anticipated. The decrease, the Agricultural Instructor states, is probably due to more than one reason, the chief being the large number of bolls that were shed just before reaching maturity. This, possibly, was caused by the plants having received a shock by severe attacks of cotton caterpillars, followed by spells of dry, hot days. Cotton stainers were responsible for some amount of damage during the month; two peasants having had one-third of their crop as stained cotton. Part of the onion seed purchased by one of the two peasants was sown, and a fair germination obtained. The seedlings were on several occasions attacked by slugs. These were kept under control by hand collecting. Throughout the district the crops are beginning to show signs of want of rain.

BARBUDA. The Agricultural Instructor mentions a continuation of the drought, reported in previous months, with greater severity during December. Hot sunny days, and the absence of rain have resulted in the drying up of the vegetation on the island. Cotton picking was continued in the Guava Field throughout the month, bringing up the total amount of seed-cotton reaped to about 25,000 lb. In cotton fields the depredations of rats continued, but to a less extent than in previous months. The presence of cotton stainers (*Dysdercus andreae*) was observed in this district on the 30th of the month. All work on minor agricultural activities has had to be completely abandoned on account of the very adverse weather conditions.

December, like the four previous months, passed away without rain. This is the fifth successive month of drought recorded for the year. It will be noticed that the drought this year has occurred in the months which have always been considered as the wet season in Barbuda. Only 60 parts of rain fell during December, the total precipitation for the year being 35·73 inches, or 18·57 inches below that of last year.

The peasants' grounds are yielding little or no food crops, and, as a result, praedial larceny is becoming very common among the people. The more energetic peasants who planted cotton early are now reaping good results. Up to the present the peasants have supplied 1,000 lb. of seed-cotton. The late planted cotton fields are a complete failure.

ST. KITTS. The Agricultural Superintendent, Mr. F. R. Shepherd, reports general routine work in the Botanic Gardens during the month of December last. There were distributed 2,300 cane cuttings from the experiment station, and 190 ornamental plants and cuttings from the Botanic Station. Concerning staple crops, there was little to report beyond the fact that there has been no improvement in the condition of the cane crop since last month. The rainfall for the month was 3·92 inches, but not sufficient to make any change in the low stunted growth, and the prospects of the coming crop are very poor. The young cane crop is being planted, but the germination must be poor, owing to lack of moisture, especially where cane cuttings have been used. The cotton crop is practically finished, only a few fields being kept for a second picking. Lands are being prepared for early planting in the northern district. Cotton stainers have been very plentiful in the fields kept for second picking, but so far, there does not seem to be much damage from internal boll rot. The rainfall for the month was 3·92 inches; for the year 39·81 inches. In the northern district the rainfall for the year was 52·12 inches.

In the summary of work performed at the Government Laboratory during December, attached to these notes, is included analysis of eighteen samples of milk from the Inspector of Police.

NEVIS. Mr. W. I. Howell reports very dry weather during the month of December, in consequence of which there is not likely to be any second picking of cotton from the demonstration plot in the Experiment Station. The first picking is completed, giving a return of 630 lb. of seed-cotton. The onion plot has been reaped, and the return therefrom is expected to average about 1,000 lb. per acre. Plant distribution included 12,000 sweet potato cuttings, and 13 lb. of Guineacorn.

The cane crop throughout the island is very poor, and the dry weather experienced since October has done considerable damage to many of the fields. Preparation and planting for next crop are in progress, but the weather is so dry that it is doubtful whether the plants will germinate. Cotton throughout the island has been very greatly damaged by the dry weather. In the late planted fields no less than 75 per cent. of the bolls have been shed; those remaining are poor, and the lint not very good. In addition to the adverse weather conditions the crop has been severely attacked by cotton stainers, which pest is more abundant this season than for some years past. Consequently the percentage of stained cotton is very high. On account of the dry weather the provision crops are making little progress, and practically no planting was done during the month; there probably will be a shortage in March and April. The rainfall for the month was 2·09 inches, and for the year 44·10 inches.

The Food Situation in Dominica.—From an address delivered by His Honour the Administrator of Dominica to the Legislative Council of that island, reported in the *Dominica Chronicle*, January 9, 1918, we quote the following remarks: 'I would take this public opportunity of impressing upon the people of this Presidency the necessity for economy, and the sin that is committed by wasting foodstuffs at this time . . . . . Dominica is most fortunate in possessing land which will grow almost all that is necessary for the support of the population. If full advantage were taken of that great fact, we should be able to endure with comfort the rationing progress which is almost certain to come in the near future. . . . . We have asked that our annual supply of flour shall be considerably less than that of normal years, but we have no certainty that even that reduced quantity will be supplied to us. . . . . In the year 1916 the amount of flour consumed in this island was approximately one-half barrel to every man, woman, and child. This, to those who know the country districts, will seem—nay is, vastly more than can be accounted for save by admitting the existence of a very great wastage somewhere. That waste should cease, or there will be a very grave lack of flour when our rations are allowed to us.

DOWN THE ISLANDS.

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BARBUDA. The Agricultural Instructor mentions a continuation of the drought, reported in previous months, with greater severity during December. Hot sunny days, and the absence of rain have resulted in the drying up of the vegetation on the island. Cotton picking was continued in the Guava Field throughout the month, bringing up the total amount of seed-cotton reaped to about 25,000 lb. In cotton fields the depredations of rats continued, but to a less extent than in previous months. The presence of cotton stainers (*Dysdercus andreae*) was observed in this district on the 30th of the month. All work on minor agricultural activities has had to be completely abandoned on account of the very adverse weather conditions.

December, like the four previous months, passed away without rain. This is the fifth successive month of drought recorded for the year. It will be noticed that the drought this year has occurred in the months which have always been considered as the wet season in Barbuda. Only 60 parts of rain fell during December, the total precipitation for the year being 35·73 inches, or 18·57 inches below that of last year.

The peasants' grounds are yielding little or no food crops, and, as a result, praedial larceny is becoming very common among the people. The more energetic peasants who planted cotton early are now reaping good results Up to the present the peasants have supplied 1,000 lb. of seed-cotton. The late planted cotton fields area complete failure.

ST. KITTS. The Agricultural Superintendent, Mr. F. R. Shepherd, reports general routine work in the Botanic Gardens during the month of December last. There were distributed 2,300 cane cuttings from the experiment station, and 190 ornamental plants and cuttings from the Botanic Station. Concerning staple crops, there was little to report beyond the fact that there has been no improvement in the condition of the cane crop since last month. The rainfall for the month was 3·92 inches, but not sufficient to make any change in the low stunted growth, and the prospects of the coming crop are very poor. The young cane crop is being planted, but the germination must be poor, owing to lack of moisture, especially where cane cuttings have been used. The cotton crop is practically finished, only a few fields being kept for a second picking. Lands are being prepared for early planting in the northern district. Cotton stainers have been very plentiful in the fields kept for second picking, but so far, there does not seem to be much damage from internal boll rot. The rainfall for the month was 3·92 inches; for the year 39·81 inches. In the northern district the rainfall for the year was 52·12 inches.

In the summary of work performed at the Government Laboratory during December, attached to these notes, is included analysis of eighteen samples of milk from the Inspector of Police.

NEVIS. Mr. W. I. Howell reports very dry weather during the month of December, in consequence of which there is not likely to be any second picking of cotton from the demonstration plot in the Experiment Station The first picking is completed, giving a return of 630 lb. of seed-cotton. The onion plot has been reaped, and the return therefrom is expected to average about 1,000 lb. per acre. Plant distribution included 12,000 sweet potato cuttings, and 13 lb. of Guineacorn.

The cane crop throughout the island is verypoor, and the dry weather experienced since October has done considerable damage to many of the fields. Preparation and planting for next crop are in progress, but the weather is so dry that it is doubtful whether the plants will germinate. Cotton throughout the island has been very greatly damaged by the dry weather. In the late planted fields no less than 75 per cent. of the bolls have been shed; those remaining are poor, and the lint not very good. In addition to the adverse weather conditions the crop has been severely attacked by cotton stainers, which pest is more abundant this season than for some years past. Consequently the percentage of stained cotton is very high. On account of the dry weather the provision crops are making little progress, and practically no planting was done during the month; there probably will be a shortage in March and April. The rainfall for the month was 2·09 inches, and for the year 44·10 inches.

The Food Situation in Dominica.—From an address delivered by His Honour the Administrator of Dominica to the Legislative Council of that island, reported in the *Dominica Chronicle*, January 9, 1918, we quote the following remarks: 'I would take this public opportunity of impressing upon the people of this Presidency the necessity for economy, and the sin that is committed by wasting foodstuffs at this time . . . . . Dominica is most fortunate in posessing land which will grow almost all that is necessary for the support of the population. If full advantage were taken of that great fact, we should be able to endure with comfort the rationing progress which is almost certain to come in the near future. . . . . We have asked that our annual supply of flour shall be considerably less than that of normal years, but we have no certainty that even that reduced quantity will be supplied to us. . . . . In the year 1916 the amount of flour consumed in this island was approximately one-half barrel to every man, woman, and child. This, to those who know the country districts, will seem—nay is, vastly more than can be accounted for save by admitting the existence of a very great wastage somewhere. That waste should cease, or there will be a very grave lack of flour when our rations are allowed to us'

COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending December 15, 1917, is as follows:—

ISLANDS. There has been only a limited demand throughout the week, the trade having temporarily withdrawn. The factors continue unwilling to make any concessions to sell, as the offerings are not very large, and holders are not urgent about selling, as they think that the cotton will be required in time.

As there is no freight room at present available for export, the buying is confined to the mills in this country.

We quote viz:—

Fine to fully Fine	73c. = 75c c.i.f.
Fine to Fully Fine, off in preparation	71c. = 73c. c.i.f.

GEORGIAS AND FLORIDAS. The Savannah market has remained quiet and dull, with apparently no demand, the sales reported consisting entirely of cotton bought in the interior towns, and only reported to the Exchange when received at the port for shipment. The limited offering stock is firmly held at prices last current, as Factors are still unwilling to make any concessions.

We quote nominally:—

Extra Choice to Fancy	74c. = 76c. c.i.f.
Average Extra Choice	74c. = 76c. c.i.f.

The exports from Savannah for the week were, to Northern Mills 220 bales, Southern Mills 104 bales, and from Jacksonville to Northern Mills, 900 bales.

The United States Census Bureau estimates the total crop as follows:—

South Carolina	8 000 bales	Total 93,000 bales.
Georgia	47,000 ,,	
Florida	38,000 ,,	

☞ This estimate is in accord with the general views of the trade, except the South Carolina crop, which it is thought may not exceed 7,000 bales.

RUBBER CULTIVATION IN TRINIDAD.

The Special Committee of the Board of Agriculture, Trinidad and Tobago, appointed in April 1916 'to investigate and to report upon the present position and prospects of rubber cultivation in the colony, and to suggest means whereby the most efficient means of tapping, and an uniform method of preparing rubber may be introduced on each plantation,' has presented its report, which is published in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Part 3, 1917.

The report is very thorough, reviewing in the first place the history of rubber cultivation in the colony, then giving its present condition, and ending by recommendations as to cultivation of the trees, and preparing the product.

The committee addressed a schedule of questions to the proprietor or manager of the 155 estates in the colony on which there was any extent of rubber cultivation. Only fifty-two replies were received, conveying in some cases much useful information. In addition, the committee visited some twenty estates, and made personal investigation into the rubber cultivation on them.

The two rubber-producing trees principally grown in the colony are *Hevea brasiliensis* (Para rubber) and *Castilloa elastica* (Central American rubber); these are dealt with separately in the report. Some trees of *Funtumia elastica* (African rubber) have also been planted in years past, and this cultivation too is reported on.

There are about 1,500 acres of rubber cultivation in the colony, and, besides, a larger area under mixed cultivation of rubber with other crops, generally cacao, but occasionally coffee or limes. On the fifty-two estates which made returns to the committee there are 130,593 *Hevea* trees, 81,975 *Castilloa*, and 45,000 *Funtumia*. These totals would of course be largely increased by the figures for the 103 estates not making returns.

The export of rubber from the colony in 1905 was 3,659 lb., of the value of £549, rising in 1907 to 27,505 lb., valued at £4,150, the highest output recorded. This decreased in succeeding years, with fluctuations, until in 1914 only 4,642 lb. were exported, valued at £500, but in 1916 it had again risen to 10,170 lb., valued at £1,524.

Dealing first with *Hevea brasiliensis*, the report states that it was introduced into Trinidad in 1876, when two plants were received by the Botanical Department from Kew.

In early days the weight of official opinion was on the side of planting *Castilloa* in Trinidad. Mr. J. H. Hart, F.L.S., late Superintendent of the Botanic Gardens, in his report on the Gardens for 1897, after enumerating the cultivated species of rubber-producing plants, gave as his opinion: 'Of these, according to our experience, the most suitable for growth in Trinidad is *Castilloa elastica*.' He apparently based this conclusion on the following grounds:—

'1st—It takes but few years before obtaining returns.

'2nd—It is easily tapped, and the latex is given off in good quantity.

'3rd—The rubber can be obtained by mechanical means.

'4th—The rubber is of the finest quality.'

In consequence of this advice, the majority of planters in Trinidad and Tobago who were taking up rubber cultivation planted *Castilloa*, while *Hevea*, on the other hand, was planted, except in a very few instances, only on an experimental scale, or among cacao.

Further investigation, however, has not confirmed the previous opinion as to the superiority of *Castilloa*. Mr. J. B. Carruthers, who succeeded Mr. Hart, came to the colony with experience of the plantations of *Hevea* in Malaya and Ceylon, and was very active in endeavouring to build up a rubber industry in Trinidad and Tobago. With this object he set about 'obtaining accurate and reliable data by exact observation and experiments.' In the only paper he published during his short time of office before his death, he stated that from general observation he was of the opinion that the growth of Para rubber under the local conditions was very little if at all inferior to that of trees, treated in the same way, of the same species in Malaya and Ceylon. Although he did not apparently feel justified, before the collection of more accurate data, in definitely pronouncing in favour of *Hevea*, he was instrumental in causing the Government to arrange for the importation of 2,000,000 *Hevea* seeds from Malaya, and in getting definite experimental work begun on an estate scale. The committee's opinion is, that the results since then obtained demonstrate that *Hevea*, under favourable conditions, gives in Trinidad a return of rubber per acre comparable with that of average estates in Ceylon and the Federated Malay States. *Castilloa*, on the other hand, has proved a costly disappointment.

The report goes on to make recommendations for the cultivation of *Hevea* as a pure crop. It is considered that

the trees when planted 14 × 14 feet are, according to Malayan experience, planted too close. Thin, overshaded trees will neither give a good yield of latex nor make a healthy bark renewal. The committee recommends the cutting out of the poorer trees in such cases, even if the resulting appearance of the field be irregular. It is advisable, in the light of knowledge acquired by later experience, to plant *Hevea*, in conformity with the best practice in Malaya, at 20 × 20 feet apart.

At such distances, seeing that the trees take several years to cover the ground, the loss of soil through wash may be very great, particularly if 'clean-weeding' is practised. It is recommended that a cover crop be grown, and *Canavalia ensiformis* (sword bean or horse bean) is suggested as eminently suitable, for the following reasons. Like most leguminous crops it adds nitrogen to the soil. Unlike other leguminous cover crops it is tolerant of a moderate amount of shade. It has very little disposition to climb, a good characteristic when planted under young trees. It makes a dense growth 2 to 3 feet high. It prevents wash. Its heavy crops of beans, maturing in from four to six months, provide a wholesome and palatable human food.

Hevea seems to suit most of the soils in Trinidad and Tobago, with the exception of the Naparima district, showing an apparently good growth even in one of the driest districts of the island of Trinidad, thus indicating that a heavy rainfall is not absolutely essential to its cultivation, provided that the subsoil is such as to be easily penetrated to a considerable depth by the roots of the trees.

After discussing various methods of tapping, the report seems to recommend the method known as the 'single quarter cut,' for the following reasons: (*a*) its extreme simplicity, (*b*) that a man can tap a greater number of trees per day than by other methods, (*c*) that instead of four, a period of seven, or even eight years may be allowed before it is necessary to tap renewed bark, (*d*) that it reduces the amount of 'scrap' rubber to a minimum.

Valuable data as to cost of production and profit per acre were supplied to the committee from two of the largest estates. In one case the cost of production per acre was given as $86·14, and the rubber produced sold at 50c. per lb., giving $147 per acre, leaving a net profit of $60·86 per acre. In the other case the profit was estimated at $61·27 per acre, a strikingly similar result compared with the first.

With respect to tapping intervals, the committee seems to agree with the conclusions reached after experiments at the St. Clair Experiment Station by Mr. W. G. Freeman, Acting Director of Agriculture, that tapping at intervals of four days will probably be the most profitable in Trinidad.

As to the care of trees, the report emphasizes the very great precaution that must be taken to guard the bark from injury, and to dress any accidental wounds with a mixture of crude oil and tar, both to help the wounds to heal, and to protect them from fungi and boring insects.

Referring to the practice of growing other perennial crops along with *Hevea*, the committee is strongly averse to cacao, on the ground that it only comes into full bearing when the *Hevea* shade becomes so heavy that the cacao has to be cut out. Besides, *Phytophthora*, a widely spread fungus disease of cacao, also attacks *Hevea*. The first objection to cacao also applies to lime trees as an intercrop. *Coffea robusta* is regarded as perhaps the most suitable crop for the purpose, if an intercrop is to be grown, as it comes into full bearing in three years, and thus gives two or three years' crops before it is too densely shaded by the *Hevea*. On the whole, however, the report seems to conclude that 'pure cultivation' of *Hevea* is the best plan to adopt.

With regard to *Castilloa elastica* (Central American rubber) which was introduced into Trinidad in 1880, the committee advises against any extension of its cultivation, although it was so strongly recommended earlier, and was largely planted. In fact it has proved so much of a failure that hundreds of *Castilloa* trees are being cut down for more profitable cultivations.

Nor is the committee able to advise any further extension of the cultivation of *Funtumia elastica* (African rubber), especially as satisfactory growth and yield are being obtained from *Hevea* even in the drier districts of the island, to which it was thought that *Funtumia* would be specially suited.

The report contains very valuable recommendations as to preparing the rubber obtained from the three species dealt with, so as to place it on the market in the best condition; these are hardly within the scope of this review.

A summary of recommendations closes the report, to which attention has already been drawn in No. 407 of this Journal. The co-operation of rubber growers is strongly advised as a means of furthering the extension of the industry, and of setting it on a sound basis.

A most useful bibliography of literature on the subject forms one of the appendices of this full and interesting report, which may profitably be read by those interested in rubber cultivation in the West Indies.

PLANTS POISONOUS TO LIVE STOCK.

The book with the above title, a review of which in *Nature* was noticed in the *Agricultural News*, Vol. XVI, No. 405, has recently been received at this Office. The discussion relating to the poisonous plants occurring in Great Britain is very full in the book in question. Some general remarks however, are worth attention by those interested in live stock everywhere.

The author states that in many cases it is practically impossible to come to any conclusion as to the degree of toxicity of a plant, owing to the want of exact information. This especially applies to the conditions obtaining in our West Indian islands, where much work remains to be done in exact study of the properties of the flora. It is noticed, for instance, that many plants are quite harmless, except when affected by fungi, etc.

A really poisonous plant may be defined as one, a small quantity of which when eaten, induces some form of indisposition with serious, or even fatal consequences, either immediately or as a result of the cumulative action of the toxic property.

The action of plants on animals may be ascertained (1) by observing the effects in cases in which it is certain that the plants in question have been eaten, or (2) by direct experimental feeding of animals with the plants. The real test as regards (2) would, in general, consist in a feeding trial in which the suspected plant occupied a place in the ration in such a quantity as might be taken in natural circumstances. Should such a test prove negative, it may generally be held that the plant is not poisonous, or only so in exceptional circumstances.

It is pointed out by the author that a number of poisonous plants have a considerable influence on the milk-yield of animals which eat them, reducing it in volume, or imparting to it an unpleasant flavour which renders it unfit for human consumption. Even if not actually poisonous, such plants must be considered harmful, as is the case with the common West Indian weed, gully root (*Petiveria alliacea*), which it is well known, imparts a most unpleasant flavour to the milk of cows which have eaten it.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
Entomologists	H. A. Ballou, M.Sc.† J. C. Hutson, B.A., Ph.D.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue draws attention to the probable continuance of food scarcity in the world, even after peace is declared.

Under Insect Notes will be found an article on the prevailing insect pests in Uganda, and another on the moth borers of sugar-cane in Mauritius.

Fungus diseases affecting plants in Uganda are the subject of an article under Plant Diseases. Another article under the same heading deals with the smut disease of corn.

The Report on the Agricultural Department, Montserrat, 1916-17, is reviewed on page 29.

Bougainvillaea Seedlings.

An interesting note has been received at this Office from Mr. H. E. Blades, of Barbados, stating that having found some seeds on a Bougainvillaea plant in his garden in April 1914, he planted them. They all grew, and most of them are now flowering. The flowers of one of them are of a distinctly different shade from those of the parent plant.

A friend of the writer's, he says, has also obtained a true hybrid—a cross between the cherry-red and the terra cotta varieties, which is growing satisfactorily.

Food Control Committee in Barbados.

Early in December the Government of the United States asked to be furnished with the requirements of foodstuffs in Barbados during the year 1918 of those heretofore imported from the United States. This information was sent by the Governor to the British Ambassador at Washington. Precisely similar information has been obtained from each of the British West Indian colonies.

The British Ambassador at Washington despatched a circular telegram, dated January 3, 1918, to these colonies, stating that all returns have been received and tabulated, and are under consideration by the United States authorities. Pending conclusions of negotiations for export, licenses will be granted immediately for one month's supply. Use of wheat and wheat flour should be discouraged, and every effort must be made to substitute corn meal, oat meal, and rye.

In a circular telegram to the several colonies, dated January 8, the Ambassador says the following procedure is suggested: 'Your Excellency to form local Food Control Committee, which will guarantee to keep imports of foodstuffs down to the amount eventually to be agreed upon with the United States.'

In accordance with the above, the Governor of Barbados has appointed a local Food Control Committee, and doubtless similar steps have been taken generally throughout the West Indies.

Stimulating Influence of Arsenic upon the Nitrogen-fixing Organisms of the Soil.

A note on the above subject was published in the *Agricultural News*, Vol. XIII., p. 133., but further researches are given in an interesting paper contributed to the *Journal of Agricultural Research*, Vol. VI, No. 2, by J. E. Greaves, Bacteriologist, Utah Agricultural Experiment Station. In the course of previous experiments the writer found that the addition of arsenic to the soil stimulates the ammonifying and especially the nitrifying micro-organisms. Further, it was found that very large quantities of arsenic had to be applied to a soil before its toxic effect became marked. This toxic effect only become pronounced when quantities of arsenic, which far exceeded those found in any of the cultivated soils, had been applied.

From data obtained by further experiments, and from results given by similar experiments carried out by other writers, it seems to be conclusively proved that

arsenic when added to the soil in the form of sodium arsenate, lead arsenate, or of arsenate trisulphide and zinc arsenite, stimulates the nitrogen-fixing powers of the soil. This stimulation is greatest when lead arsenate is applied and least when zinc arsenite is used. Paris green (cupric aceto-arsenite) did not stimulate in any of the concentrations, but became very toxic when the concentration reached 120 parts per million. The toxicity of this compound is due to the copper, and not to the arsenite contained in it. Sodium arsenate became toxic when a concentration of 40 parts per million was added, and 250 parts per million of arsenic entirely stopped nitrogen fixation. On the other hand, lead arsenate was not toxic even at a concentration of 400 parts per million of arsenic, while the toxicity of arsenate trisulphide and of zinc arsenite was very small at this concentration.

The above is of special interest in the West Indies, on account of the use in cotton cultivation of Paris green as an insecticide.

Only one type of Azotobacter was isolated which was stimulated by arsenic, and in this case the stimulation was due to the organism utilizing its source of carbon more economically in the presence of arsenic than in its absence. Thus arsenic and its compounds do not act as sources of energy to the organism. The main part of the stimulation noted in the soil with its mixed organisms is undoubtedly due to the inhibiting of injurious species by the arsenic.

Arsenic cannot replace phosphorus in the vital process of the nitrogen-fixing organism, but it can in some manner liberate the phosphorus from its insoluble compounds. This may either be a direct or an indirect action.

Breeding Pure-Bred Stock.

Pure-bred stock represents the accumulated effort of generations of breeders leading to a well defined end, which may be expressed in profits already realized, or in profits to be realized in the future.

In a review of some literature on the above subject, a writer in the *Agricultural Gazette of Canada*, October 1917, considers that to the intelligent breeder the pedigree is the most important consideration to be kept in mind. If there are animals, whose excellence has been proved, most closely related to the genealogical tree, and if they occur in both branches of the genealogy at the same time, the breeder may feel a certain sense of security with regard to the power of the strain to transmit superior characteristics. The greater the number of descendants whose worth has been proved, the greater is the certainty as to dominance of desired characteristics. With regard to valuable animals, the length of the pedigree is looked upon by breeders as an indication of marked powers of reproduction and selection. The length of the pedigree is an equally valuable criterion in the descendants, and it is here that a pure-bred animal is superior to an ordinary one. The breeder of pure-breds, who studies the indications connected with hereditary power, and acts on these indications, is assured of profits which cannot be realized in ordinary animal production for general market purposes.

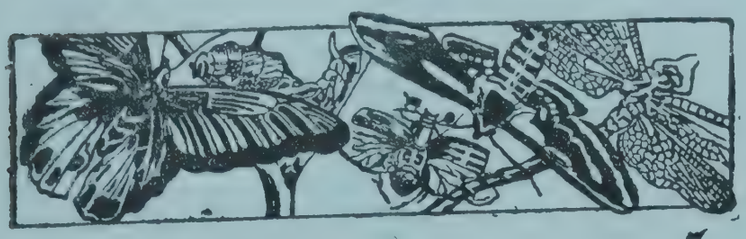
Poultry Feeding Places.

The *Queensland Agricultural Journal*, September 1917, refers to a bulletin of the West Australian Department of Agriculture, on the subject of the necessity of cleanliness in the feeding places of poultry.

In many places the food is scattered on the ground and the birds are continually fed within a small space. The surface of that space soon becomes foul with the droppings of the flock. It is true that sunshine partially acts as a germicide, but generally the spot becomes quickly contaminated with the continual trampling of the fowls, and if there be one sick fowl among them, the whole flock may soon become infected. Spading up of the feeding place once or twice a week will bring good results. It will tend to purify the ground, and will induce exercise on the part of the birds because of their having to scratch for their grain, and this is always desirable, especially when poultry are confined in yards. If also grain is scattered as the ground is spaded up, much will be buried so deep that fowls will not scratch it out, and some of it will be thrown up at the next spading having already sprouted, and the green succulent blades are much relished by fowls. Of course it must be remembered that the constant turning over of the same soil in a small poultry run may eventually mean the reworking into the soil of heaps of droppings, which is not good for the health of the fowls.

Growing of Corn.

An article on the above subject by Mr. H. W. Lynch, Agricultural Instructor, Jamaica, appears in the *Journal of the Jamaica Agricultural Society*, November 1917, which would seem to apply, after making allowance for somewhat different conditions, to many of the smaller islands. The writer says, in answer to the question as to how much corn Jamaica is capable of producing, that if 50,000 acres were planted with corn as only a catch crop, and if the yield were 20 bushels to the acre, the 1,000,000 bushels would be just about four times as much as the usual importation of corn into Jamaica. Touching the question as to why so little corn, comparatively speaking, is grown in Jamaica, he says it depends upon whether it pays, and that depends, on the other hand, on how it is grown. If a man plants 1 acre of cassava or potatoes, and plants peas and corn through it, and then gets only 10 bushels which he sells at 3*s.* per bushel, it pays him, for he gets cassava and peas for his labour, and the corn is net profit. But if a man plants 1 acre of corn alone, after the cost of cleaning, weeding and harvesting is met it does not pay to sell at 3*s.* per bushel, even if it yields 20 bushels. To grow corn as a staple, and make it pay at 3*s.* per bushel, it is necessary to plant it so that the yield per acre shall be more than 20 bushels. This can be done, for a yield of over 90 bushels to the acre has been obtained in some parts of Jamaica. If by selection of seeds, and proper tillage and manuring, the average yield is increased to 50 or 60 bushels per acre, it will pay well to grow corn even as a pure crop.



INSECT NOTES.

INSECT PESTS IN UGANDA.

The Annual Report of the Department of Agriculture of Uganda, for the year ended March 31, 1917, contains an interesting record of the progress of agriculture in the Protectorate during the above period, and since many of the crops grown in Uganda are similar to those grown in the West Indies, certain points of interest connected with these crops will be referred to in this number of the *Agricultural News*. The following notes dealing with those insects which are of special importance to readers in these islands are taken from the report of the Government Entomologist, Mr. C. C. Gowdey, and are arranged under their respective host plants.

COFFEE. This crop is attacked by sixteen species of scale insects, most of which are of no special economic importance. The most important of these is the mealy-bug *Pseudococcus citri*, Risso, which occurs almost everywhere in tropical regions. This species not only clusters on the coffee flowers and newly set fruit, sometimes causing these to drop, but also infests the foliage and the roots. Mr. Gowdey gives a brief account of the life-cycle of the insect, as follows: 'The eggs are laid on the fruit, twigs, under the loose bark on the stem, and roots. They are enclosed in light cottony material in clusters varying from 300 to 500 in number. The period of incubation is about eight days. The newly hatched larvae are light yellow in colour, and at first are devoid of any waxy covering, and hence it is at this stage that remedial measures would be the most effective. The larvae moult three times, about fifteen days elapsing between each moult. Egg-laying begins about ten days after the final moult—that is after the adult stage is reached—and death soon follows oviposition.' The other species of scale insects mentioned under coffee, which also occur in the West Indies, though not always on coffee, are *Pseudococcus virgatus*, *Coccus viridis*, *Saissetia hemisphaerica*, *S. nigra*, *Selenaspidus articulatus*, and *Ischnaspis longirostris*.

The coffee leaf-miner, (*Leucoptera* [*Cemiostoma*] *coffeella*), Staint., has recently appeared as a pest in Uganda, but is at present confined to one district This insect is a minute, silvery, white moth, which lays its eggs on the leaves. The larva, on hatching, bores into the leaf, and feeds between the upper and lower surfaces. It eventually causes a large brownish blotch due to the drying of the upper surface of the leaf, and badly infested leaves often drop. The larva becomes full-grown in about two weeks, and, crawling out, pupates on the outside of the leaf. The moth emerges in about a week. Mr. Gowdey finds that the only control measure is the 'collection of the infested leaves, those that have fallen as well as those remaining on the trees.' It may be mentioned that this leaf-miner is abundant on coffee in Porto Rico and Cuba, but in both of these islands the larva is parasitized to some extent by minute hymenoptera.

COTTON. Species of cotton stainers, *Dysdercus* spp.and *Oxycaraenus* spp., are mentioned as being abundant on cotton. The species of Dysdercus in the West Indies are now known to be disseminators of certain internal boll diseases, which are apparently not present in Uganda. These boll diseases are the principal cause of the staining of the lint which was formerly thought to be due to excrement deposited by the bugs. In this connexion it may be mentioned that measures are now being taken in some of the cotton-growing islands of the Lesser Antilles to control the stainers by the eradication of their wild food-plants, and this method has so far proved very successful in St. Vincent.

RUBBER. Ceara and Para rubber trees were badly infested with the bourbon scale (*Aspidiotus destructor*, Sign.), and in several cases the Ceara trees were killed.

FRUIT TREES. A list is given under their respective host plants of the various insects attacking fruit trees. Among the insects attacking orange trees are the orange butterfly (*Papilio demodocus*, Esp.), and the fruit fly (*Ceratitis capitata*). Caterpillars of the butterfly genus Papilio occur as pests of the leaves of citrus trees in many parts of the world, and sometimes defoliate the trees. Two species are recorded from Cuba, namely *P. andraemon* and *P. thoas*. In British Guiana the species *P. anchisiades* sometimes defoliates orange trees, but insects belonging to this genus are not known to be injurious to orange trees in the Lesser Antilles.

The fruit fly mentioned above is the Mediterranean fruit fly, which is a serious pest in some parts of the world. Although this species is not known to occur in the West Indies, it has been established in Bermuda for many years (*Agricultural News*, Vol. XV, p. 10). An account of this fly, as it occurs in Uganda, was given by Mr. Gowdey in his Annual Report for 1912-13, and was reproduced in the *Agricultural News*, Vol. XIII, p. 122.

Among the scale insects mentioned as occurring on fruit trees are *Lepidosaphes gloveri* and *L. citricola* on orange, and *Aspidiotus destructor* on mango, guava, and banana.

The shade tree (*Gliricidia maculata*) is mentioned as being seriously attacked by the scale insects, *Pseudococcus citri* and *Coccus longulus*, and by the aphid *Toxoptera coffeae*. This plant is sometimes used as a shade tree or as a wind-break in cacao and lime orchards in the Lesser Antilles, but so far has been remarkably free from pests.

In conclusion, Mr. Gowdey gives a list of some of the parasitic and predaceous insects which he has succeeded in breeding, and this list shows that many of the crop pests in Uganda have their own particular insect enemies.

MOTH BORERS OF SUGAR-CANE IN MAURITIUS.

In view of the importance of the moth borer (*Diatraea saccharalis*) wherever sugar-cane is grown in the West Indies, it may be of interest to give a short account of the moth borers attacking sugar-cane in Mauritius. These pests have been studied by M. d'Emmerez de Charmoy, the Entomologist, and the results of his work have been published as *Bulletin No. 5*, of the Mauritius Department of Agriculture.

There are four species of moth borers which attack sugar-cane in Mauritius, and these are known respectively as the pink borer (*Sesamia vuteria*, Stoll.), the spotted borer (*Diatraea saccharipha*, Bojer), the white borer (*Grapholita schistaceana*), and the brown borer (*Alucita sacchari*, Bojer).

The pink borer is distributed throughout the island and is known in many sugar-growing countries, but has not been recorded from the West Indies. It is very common on many graminaceous weeds, on some of which it lays its eggs

The young caterpillars pass their early stage on these weeds, tunnelling into the stems, and later go to the sugar-cane. The best remedy is to keep the fields clear of weeds, but this can rarely be practised in Mauritius owing to shortage of labour. Other methods, however, can be used, such as cutting out of dead hearts, rotation of crops, and growing catch crops to keep down weeds.

It is strongly recommended in Mauritius that on no account should sorghum, maize (Indian corn), or any other plant related to sugar-cane be used as a catch crop, as the cultivation of these crops in close proximity to the canes would only serve to increase the infestation with moth borers.

It has been found that maize can be planted in Mauritius as a trap crop on definite areas, and carefully watched and destroyed when the plants become well infested. Experience has shown that the pink borer has so marked a preference for maize that this crop can be used not only as a preventive against infection, but that it even serves to check an infection which may have broken out.

The spotted borer is not as serious a pest in Mauritius as the above species. The eggs are not laid merely on the leaf-blades, as is the case with the West Indian species, but may be laid on almost any part of the plant above ground, and are consequently very difficult to find. The collection of egg-masses, as practised in the case of *Diatraea saccharalis*, is of no value against the Mauritius species. The measures recommended against the pink borer may also be used with this species, since it frequents graminaceous weeds in the same way that the pink borer does. Both these species have parasitic enemies in common.

The white borer moth lays its eggs on the leaf-blade or on the sheaths, and the young larva crawls down and enters the underground portion of the shoot. It does not go immediately to the centre of the plant as do the other two species, but reaches the heart by ascending spirally. The cutting out of dead hearts is recommended, care being taken to destroy all plants so cut, since it is important to destroy any eggs laid on the leaves or stem. The plant should be severed well below the surface of the soil, and as near as possible to its point of attachment with the stool.

The brown borer as a rule only attacks cane shoots that have been injured by the other borers, or stalks that are diseased. It is advisable in planting not to use infested or diseased cuttings.

M. de Charmoy also gives an account of the natural enemies of these borers, both parasitic and predaceous, with descriptions of the species of parasites.

J.C.H.

WOOD OR CANDLE NUT OIL.

In forwarding to the Imperial Commissioner of Agriculture for the West Indies an advance copy of a note to be published in the last number of the *Kew Bulletin* for 1917, the substance of which is reproduced below, Mr. A. W. Hill, Assistant Director of the Royal Botanic Gardens, Kew, remarks: 'As it is probable that the demand for drying oils of this particular character will increase in the future, we are inclined to think that the cultivation of the tree on a large scale in British dominions, and especially in the West Indies, may be worthy of serious consideration.'

The special demand for the oil yielded by the seeds of *Aleurites* spp. is in connexion with varnishes used for aeroplanes. The chief source of this type of oil is *A. Fordii*, the Chinese species, but owing to difficulties of transport supplies from this source are not now readily available.

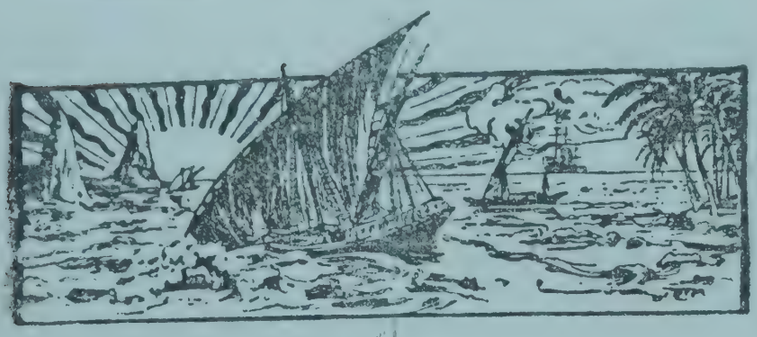
Attempts have been made by obtaining a number of seeds of *A. Fordii* from the Botanic Gardens, Hong Kong both in 1912 and 1916, to grow this species in the Botanic Gardens of several of these islands, but without success. The seeds have germinated in most cases, but after some time the plants have failed completely, showing that they are unsuited to West Indian conditions. On the other hand, *A. triloba* grows well and fruits abundantly in most of the smaller West Indian islands, notably in Nevis and Dominica. It would seem advisable to experiment further with systematic cultivation of this species in favourable localities, in view of the opinion quoted above, and the note in the *Kew Bulletin*, which follows:—

'Candle nut or Indian Wālnut (*Aleurites triloba*, Forst.). A tree 40 to 60 feet high; native of Polynesia and Malaya, distributed by cultivation to India, Burma, Ceylon, Hong Kong, Mauritius, West Indies, East Africa.

'Allied species *A. cordata*, R. Br., *A. Fordii*, Hemal., and *A. trisperma*, Blanco, have been dealt with in previous issues of the Bulletin. As a source of oil the species under consideration is of equal importance. The seeds contain a large quantity of oil which is obtained by expression, and because of its drying properties is used for mixing with paints under the name of Country Walnut Oil. The kernels, when dried and stuck upon a stick, are used as candles in the Polynesian Islands.

'The nuts and oil have been reported to be edible; but this is open to serious question, as considerable difference of opinion exists amongst writers on the point. Having regard to the Order (*Euphorbiaceae*), and the close alliance with species known to be distinctly poisonous, it would be inadvisable to rely on the oil for table use; it can be readily dispensed with for this purpose since we have so many more oils of proved quality and that come nearer the standard of "olive oil." The nuts might pass locally for food, but only when quite fresh. According to the *Tropical Agriculturist*, "the half-ripe fruits with salt have a delicate flavour, but the ripe fruits are unwholesome and only eaten in time of scarcity. This uncertain character is borne out by the variation in analyses of the oil, some comparisons of which are given in *Colonial Reports*, No. 88 (Misc. Series) pp. 419-50. The oil, however, is of growing importance because of the industrial uses to which it may be put, and the above report bears out the opinion already referred to as to the drying properties, typified by linseed oil, and recommends it "for the manufacture of softsoap, the preparation of oil varnishes, paints and linoleum, and for other similar purposes to which oils of this class are applied industrially." Further, the value (1906) for nuts in Europe is given at £12 to £13 per ton, and of the oil (1911) at £28 to £30 per ton, with the residual cake at £1 10*s.* to £2 per ton—suggested for fertilizing. The percentage of oil in the kernels has been variously quoted at from 50 to 68, and where the oil cannot be expressed locally it is recommended that only the kernels be exported to this country. An analysis of the kernels from one of the Pacific Islands is recorded in the *Agricultural News*, Barbados, October 6, 1906. In Ceylon the nuts are known as "Kekuna", and an important paper entitled "Candle Nut (Kekuna) Oil as an Industry" is published in the *Tropical Agriculturist*, Vol. XLVIII, May 1917, pp. 300-2 urging its cultivation, which, as the tree grows so freely, should not be attended with any difficulty. Planting 25 to 30 feet apart in protected situations up to 2,600 feet above sea-level is recommended, and the tree is said to bear at the end of the second year.'

It may be noted that an account of the efforts to introduce *A. Fordii* into the West Indies, and of the value of its nuts as a source of drying oil, appeared in the *Agricultural News*, Vol. XII, p. 403.



GLEANINGS.

By a Proclamation issued by the Governor of Barbados dated January 14, 1918, all foodstuffs ordinarily used as food by man, and two articles of stock feed, namely oats and pollard, are forbidden to be exported from the island.

The Governor of Jamaica has announced that owing to the shortage of foodstuffs in England, he proposes to limit the importation of food into Jamaica. The colony, he said, must grow more food, and feed itself. (*The Times*, December 21, 1917.)

Out of the 49,201 tons of palm kernel exported from Sierra Leone in 1913 Germany secured 43,016 tons. The position is now reversed. Of the total quantity exported in 1916, which amounted to 45,316 tons valued at £680,705, practically the whole went to the United Kingdom. (*Colonial Reports*—Annual, No.939.)

The advent of the first mill making white sugar direct in Porto Rico marks a new era in the industry in the island. It has been put up at Central Constancia at Ponce. The installation cost $250,000, and the plant will be capable of dealing with 250 tons of cane daily. (*Louisiana Planter*, November 10, 1917.)

A note in the *Louisiana Planter*, November 3, 1917, says it is well known that cane planters and beet growers are more and more solving the problem of labour on their fields, in ploughing and cultivating by the use of tractors. A recent report states that there are now 34,371 tractors in use all over the United States. This number has certainly increased since that report.

Mr. H. B. Cowgill, of the Experiment Station in Porto Rico, has published in the *Journal of the Department of Agriculture* of Porto Rico for July 1917, a method of identification and description of sugar-cane varieties. He truly says that the number of varieties of sugar-cane is increasing rapidly, and for this reason it is desirable to have a method of accurately describing and identifying them.

In British Guiana the art of straw plaiting for making Panama hats is being regularly taught in some of the Girls' Primary Schools, the young leaf shoots of *Carludovica palmata* grown at the Botanic Gardens, Georgetown, and the Experimental Rubber Farm, Issororo, N. W. District, being supplied to the schools, as the raw material for the purpose, by the Department of Science and Agriculture. (*Combined Court Minute Paper*, No. 927, 1917, British Guiana.)

In order to make the best use of her existing resources, India must give up most of her industrial crops for both seasons of 1918-19, and concentrate her energies entirely on food grains—in a word, increase her output of grain by as many million tons as possible. She is one of the few countries which can talk lightly about millions of tons; she is in a position to add to her production of food grains an amount which might make all the difference to the world. (The *Agricultural Journal of India*, October 1917.)

In a printed reply to Colonel Faber, who asked how many tractor ploughs had been supplied by the Government, how many acres had been ploughed, and at what cost, Mr. Prothero, President of the Board of Agriculture says, that the number in England and Wales, up to November 1, was 1,618, of which about 1,000 had been supplied since July 1. The area ploughed to November 1 was estimated at about 200,000 acres. The average gross expenditure throughout England and Wales on the running expenses of tractors amounted to 28*s*. 6*d*. per acre, but it is known that since August the average cost has been reduced. (*The Times*, November 13, 1917.)

It is contended, and the contention is supported by a great and growing volume of evidence, that where tractors have been properly used and adequately supervised they are progressively useful in agricultural operations. It may be impossible entirely to guard against bad weather, shortage of spare parts, and various other causes; but doubtless in the past much of the indifferent work done by tractors has been due to an unwise selection of the land on which they were put to work, slack control, or want of skill on the part of the men entrusted with them. (The *Journal of the Board of Agriculture*, November 1917.)

The utilization of kelp for obtaining a supply of potash in California was noticed in a recent issue of this Journal. Similar experiments which are recorded in the *Agricultural Gazette of Canada*, November 1917, have been conducted in Nova Scotia on a sea-weed of the Atlantic coast, *Fucus nodosus*. The sea-weed is dried and ground until the finished product bears a close resemblance to coffee in appearance. As a fertilizer it has given good results. When, however, normal prices for nitrogen and potash obtained, this product could not have been prepared and used economically; but under existing conditions the possibilities of this source of potash seem to invite further investigations.

Two Japanese companies are being formed for the purpose of engaging in the sugar industry in the Dutch East Indies. One company, it is understood, has purchased a large sugar mill in Java. The other company is being established for the purpose of purchasing suitable cane-growing land in Java and Sumatra. The capital of this company is stated to be about £612,000. It has already purchased a sugar estate in Sumatra, and a tract of land in Java to be brought under cane cultivation. Manufacturing operations will be commenced with a plant of a daily capacity of 300 tons, which it is intended to increase later to a capacity of 1,500 tons. (*The Board of Trade Journal*, November 8, 1917.)

MONTSERRAT: REPORT ON THE AGRICULTURAL DEPARTMENT, 1916-17

This report, which has just been issued, is longer than usual, and is full of interesting matter. It shows that the Curator, Mr. Robson, not only takes a keen interest in the agricultural welfare of the island, but is doing good work in promoting that welfare. It seems somewhat of a pity that the space available at the Botanic Station in Montserrat should be so limited, but it is plain that good use is made of this limited area. In connexion with the gardens, the remarks on hedges bear out what has been several times noted in this Journal, that 'Bread-and-cheese' (*Pithecolobium unguis-cati*) is probably one of the best plants for a hedge in the tropics, although the sweet lime (*Triphasia aurantiola*) is rightly mentioned as forming a most ornamental hedge. A number of peach trees have been growing at the station for some years, but there has been no indication of their successful fruiting, and accordingly most of them have been cut down. From experiments made in the germination of bay tree seeds it has been demonstrated that they can easily be raised in seed-beds under shelter, and after the young plants are established the shade can be removed, and the plants transplanted into nursery beds without further protection from the sun. Seeds of the bay tree have been sent from Montserrat to Egypt, Jamaica, and East Africa. The seeds were packed in powdered charcoal mixed with water in the proportion of 4 fluid ounces to 1 lb. of charcoal, which proved a satisfactory method of conveyance.

Mr. Robson is conducting a series of experiments on breeding cotton to fix a type which will be satisfactory to the cotton growers of that island, and also to the spinners. Ten varieties were tested for yield, and the following details were examined: (1) the actual yield of lint, (2) the broker's valuation of a sample of lint, (3) proportion of lint to seed, (4) size of the bolls, (5) behaviour of lint under spinning test, (6) the purity of the strains as indicated by the lint lengths and the percentage of lint on a given number of plants.

As regard the spinning tests, five samples were forwarded to the Vice-President of the Fine Cotton Spinners' and Doublers' Association of Manchester, who reported that all five samples were of high grade, and approximated closely to the better St. Vincent types. Lint from two varieties, namely Douglass, the strain which is highly valued in St. Kitts, and H. 9Th., which has been thought most highly of in Montserrat, was submitted to Mr. E. Lomas Oliver, who reported that if the samples represented what the bulk of the Montserrat crop is as regards quality, that the difference in price, which then existed between St. Kitts and Montserrat cotton in favour of the former, will doubtless soon disappear altogether; for the samples were most excellent cotton, and all concerned were to be congratulated on so steadily maintaining and improving the quality of cotton grown in Montserrat.

Turning to the lime industry, it appears that it is not in a very satisfactory condition. The area under cultivation is lessening, and there seems to be a feeling that the conditions of this cultivation need considerable improvement. Experiments are being conducted as to the benefit which may result from spraying young lime trees for the extermination of the purple scale, which is looked upon as a very serious pest.

The bay oil industry is receiving considerable attention, as is shown by the fact that no less than 50,000 bay plants have been distributed from the Station in the last four years, and the demonstrations at the Station of the proper care and treatment of bay trees must be of great value to those interested in the industry.

It would not seem from the returns on experimental shipments made to Canada, that the cultivation of pine-apples as a crop in Montserrat would be sufficiently remunerative.

Among the leguminous crops experimented with was a species of *Stizolobium* or *Mucuna*, a sample of which was forwarded to the Imperial Institute for examination. The interesting report received will be published in the next issue of this Journal.

The results of the yield of eighteen different varieties of sweet potatoes are given in the report. The best of them, known as North No. 4, gave an estimated yield of 21,318 lb. This same variety, however, only gave an estimated average yield on fourteen experiments of 12,864 lb. This variety is supposed to be of local origin. Of the introduced varieties, Trinidad No. 1 took the first place, giving an average yield on nine experiments of 14,967 lb.

Cotton stainers damaged the crop in Montserrat to a considerable extent, the proportion of stained cotton in last season's crop being 7·7 per cent. Mr. Robson advises that the same destruction of host plants of the stainer be carried out in Montserrat as has proved beneficial in St. Vincent. The quality of the cotton now being exported from the island has evidently steadily improved in recent years, and the island is fortunate in having an industry so well suited to local conditions; no efforts should be spared to further its interests. Mr. Robson thinks that sugar-cane would be a satisfactory rotation crop for cotton, except for the difficulty that the reaping season for cane overlaps the planting season for cotton. He suggests that a bean or pea crop will be found to answer every purpose as a rotation crop. This opinion appears thoroughly sound, especially in view of the need of increased local supply of foodstuffs.

Onion cultivation is receiving considerable attention, and the industry is furthered by the successful working of the Montserrat Onion Growers' Association in co-operation with the similar association in Antigua.

From a table of principal exports it appears that 394,049 lb. of cotton lint, valued at £33,079, together with 448 tons of cotton seed, valued at £3,188, were shipped from Montserrat in 1916, being a long way its principal industry. The second place is taken by lime products. Of these 116,447 gallons of raw lime juice, valued at £17,185, and 3,188 gallons of concentrated lime juice, valued at £739, together with 235 cwt. of citrate of lime, valued at £352, were exported. The export of papain is peculiar to Montserrat of all the smaller West Indian islands. In 1916 this reached the considerable total of 2,476 lb., with a value of £1,560. The sugar industry, which for some years past has been almost a negligible quantity, has, as in most of the smaller islands, witnessed a considerable extension, 417 tons of sugar having been shipped in 1916.

PLANT DISEASES.

PLANT DISEASES IN UGANDA.

The Annual Report for 1916-17 of the Department of Agriculture of the Uganda Protectorate contains references to diseases of cultivated plants which are of interest for comparison with those of older established cultivations elsewhere in the tropics.

The principal export crop is cotton, which it is estimated covered 130,000 acres. This is followed in importance by coffee and rubber, and as small but developing industries, by cacao, tea, sugar-cane, and tobacco. With regard to cotton it is reported that as the result of adverse weather conditions the losses were exceedingly heavy, and there was a large percentage of stained and immature fibre. At the Government Plantation heavy rain in the midst of the picking season resulted in the proportion of bolls diseased and spoilt by the weather reaching 90 per cent. Early and late cotton was alike affected. Specific information as to the modes of loss is scanty, but the Government Botanist, Mr. W. Small, reports that anthracnose and areolate mildew were common. No reference is made to the presence of *Bacterium malvacearum*, the most widely distributed cause of serious disease in this crop in the West Indies.

The principal disease of coffee appears to be die-back, of uncertain causation, but following in many cases on the bearing of a very heavy crop.

In this affection the primaries and twigs are most frequently attacked at the joint, but the middles of young primaries also often become affected. The affected part turns black, and the tissue breaks down. In the early stages such primaries present a sickly appearance, the leaves at the apex hang down, wither, and fall off. The primaries eventually become dry sticks. In some cases laterals grow out from one or two of the older nodes.

The fungus *Colletotrichum coffeanum*, Noack, is closely associated with the disease, occurring even in its early stages. It is not invariably present, and the Government Botanist takes the view that it cannot be held responsible for the die-back that occurs on such a large scale.

It is the opinion of that officer that die-back, in the sense of the weakening and frequent deaths of trees which follow over-bearing, especially at the time of the first heavy crop, is more to be feared in Uganda than the notorious Hemileia disease. The latter is always present on *Coffea arabica* but its effects have not the disastrous nature of those attributed to it elsewhere.

Cercospora coffeicola, causing a leaf and berry blotch, is always to be found on coffee estates but was not much in evidence during the year. A root disease characterized by black rhizomorphs has occurred on coffee, cacao, tea, rubber, and indigenous trees.

The most harmful of Uganda cacao diseases is the die-back familiar in the West Indian and other cacao districts, associated with *Lasiodiplodia theobromae*. A soft rot of the pods is attributed to the same fungus. A fungus identified as *Colletotrichum theobromicolum*, Del., causes a destructive hardening of the pods. A similar disease, possibly identical, occurs occasionally in the West Indies, and has been recently met with causing reddish-brown hardened patches on immature pods in St. Vincent.

On Hevea, die-back attributed to the same fungus as in the case of cacao has been fairly common. Other recognized diseases of rubber have not as yet made their appearance in the Uganda plantations.

The conclusion reached is that Uganda is still in a favourable position as regards the frequency of plant diseases and the harm done by them, but it is recognized that this state of affairs cannot be expected to continue for an indefinite period.

The reference to root diseases of permanent crops indicates the approach of a troublesome stage which has to be passed through in all tropical countries where plantations are established on forest land. The fungi encountered vary with the situation, but have this character in common, that they spread from stumps and logs and soil rich in the accumulations of forest debris. If their advent is foreseen, much can be done to diminish their effects; if early precautions are neglected, depressing losses have to be faced, and the problem of eradication becomes far more difficult.

W. N.

FACTORS AFFECTING THE SMUT DISEASE OF CORN.

In view of the occurrence—varying in intensity, but never as yet reported to be severe—of the smut disease of Indian corn in these islands, the following summary of conclusions reached in a study of the fungus by E. J. Piemeisel (*Phytopathology*, VII, 4, 294-307) is reproduced:—

1. The infection of corn by *Ustilago Zeae* (Beckm.) Unger., is purely local; no evidence of systemic infection was obtained.

2. When very young plants become infected they are often killed.

3. Injury to the host plant, close planting, very early or very late planting, and growth on rich soil are conducive to heavy smut attacks.

4. Vigorously growing plants, between 2 and 3 feet high, are most susceptible to smut attack.

5. The spores of *U. Zeae* can cause infection either when young or old. Spores germinate readily as soon as mature, and retain their viability for several years; infection was obtained by inoculating corn plants with spores five years old.

6. The corn-smut fungus does not lose its virulence quickly when grown on artificial media.

7. The spores of *U. Zeae*, almost without exception, lost their viability after having been kept in a silo for a few weeks.

8. The factors causing spores to lose their viability in the silo have not been determined definitely; it seems probable that the silage acids, especially acetic, may be the destructive agents.

9. Sporidia were kept in pure culture continuously for three and a half years, at the end of which they remained viable. Inoculation experiments with the same material gave inconclusive results.

10. Sporidia were desiccated for about five months without seriously impairing their viability.

11. Freezing injures sporidia but little; alternate freezing and thawing, however, is injurious to moist sporidia, less so to desiccated sporidia.

12. The optimum temperature for the budding of sporidia is between 20° and 26° C., the maximum at about 40°C., and the thermal death point near 46°C.

13. Sporidia can germinate and bud in silage juice but are injured in a solution containing acids in the proportionate concentration in which they occur in silage.

14. The ability of sporidia, as well as spores, to withstand unfavourable conditions is very significant in explaining some of the facts in the parasitism of *U. Zeae*.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of November 1917:—

In reviewing the conditions of the drug and spice market during the month of November, it is necessary to say that the business of five weeks, instead of the usual four weeks, comes under review, as the 1st and 29th of November both fell on a Thursday—the day of the week on which the drug auctions are always held. With regard to the condition of the markets from week to week, but little or no change can be reported, either in supply or demand, since our report for October. Buyers do not proceed beyond satisfying their immediate wants, and with regard to prices the general tendencies are upwards. The following are the principal items of interest.

GINGER.

At auction on the 8th of the month ginger was in quiet demand. Some 812 packages of Cochin and Calicut were brought forward, and 114 sold at 65*s.* per cwt. for brown rough Calicut: sound was all bought in at from 72*s.* to 74*s.* Some 100 bags of Sierra Leone were bought in at 65*s.* A fortnight later ginger was again in steady demand and in plentiful supply; 420 packages of Cochin and Calicut were brought forward, and 281 sold, 67*s.* 6*d.* being paid for fair, washed, rough Cochin, and 65*s.* for bold, brown, rough Calicut. Some 100 bags of Sierra Leone were also offered, and bought in at 60*s.* per cwt.

MACE AND PIMENTO.

Mace has commanded slightly advanced prices on previous rates, and has been in good demand. Thus at auction on November 7, 4 cases from Java of fine, bold, palish realized 4*s.* 2*d.* to 4*s.* 3*d.* per lb.; while 2 other cases from Penang of bold character, but somewhat wormy, fetched 4*s.* to 4*s.* 2*d.* Some 20 cases of Bombay were also disposed of at $7\frac{3}{4}d.$ to $8\frac{1}{4}d.$ per lb. Towards the end of the month some 31 cases of flat, red Singapore were disposed of at 3*s.* 8*d.* to 3*s.* 10*d.* Pimento has been in good demand during the month. At auction on the 7th, 500 bags were offered and sold at $4\frac{1}{4}d.$ per lb., a price that was slightly less towards the end of the month, when 434 bags were offered, described as the result of a Prize action.

SARSAPARILLA.

It was reported in the early part of the month that the prices generally of sarsaparilla had advanced, and that 2*s.* 3*d.* per lb. was asked for Mexican. On the 15th of the month the offerings at auction were as follows: grey Jamaica 10 packages, native Jamaica 8, Mexican 17, and Honduras 9. None of the grey Jamaica was sold, 4*s.* per lb. being asked; while 7 packages of the native Jamaica found buyers at the following rates: 2*s.* 3*d.* to 2*s.* 4*d.* per lb. for red and yellow mixed, and 1*s.* 10*d.* to 1*s.* 11*d.* for dull red partly sea-damaged. Of the 17 bales of Mexican, 5 only were disposed of at 2*s.* 3*d.* per lb.; out of the 9 bales of Honduras 3 only were sold at 3*s.* 3*d.* per lb.

CITRIC ACID, ARROWROOT, LIME OIL, CASSIA FISTULA, KOLA, and TAMARINDS.

Citric acid has remained at from 3*s.* $2\frac{1}{2}d.$ to 3*s.* 3*d.* throughout the month. It has been stated, however, that it is the intention of the Italian Government to advance the price of the raw material by 60 per cent. At auction on the 1st of the month arrowroot was in very full supply, amounting to several hundred barrels of fair to fine manufacturing St. Vincent, part of which was disposed of at from $5\frac{15}{16}d.$ to $6\frac{1}{2}d.$ per lb., a price which varied only slightly throughout the month. The price of lime oil in the middle of the month was 7*s.* per lb. for distilled, and 16*s.* for hand-pressed. At auction on the 17th of the month 77*s.* 6*d.* per cwt. was asked for Cassia Fistula pods. Kola was in good supply at the auction on the 15th, as many as 161 packages being offered, and sold at from $9\frac{1}{4}d.$ to $9\frac{1}{2}d.$ per lb. for medium to bold, dried Java halves. At the same auction the large consignment of 188 barrels of Antigua tamarinds was disposed of at 35*s.* 6*d.* to 37*s.* 6*d.* per cwt.; and for Montserrat, 37*s.* 6*d.* to 39*s.* 6*d.* was paid.

TANNING POSSIBILITIES IN THE WEST INDIES.

The tanning of locally produced hides and skins has been undertaken more or less successfully in most of the West Indian islands on a small scale from time to time, Jamaica being the only one, as far as the writer of this article is aware, where the industry is carried on somewhat extensively and scientifically in fairly large tanneries. In the smaller islands, such as Barbados, Grenada, St. Lucia and Antigua, there are small attempts made at tanning by individuals here and there, with a very limited output. In some of these cases the product has not been able to compare favourably with imported leather.

Owing to the difficulty under present conditions of obtaining imported leather, renewed interest has been shown in this direction. In Antigua for instance, Mr. Collens, Superintendent of Agriculture, at a meeting of the local Agricultural and Commercial Society in August 1917, pointed out the possibilities of a local tanning industry, as was noticed in Vol. XVI, No. 404, of this Journal. In St. Lucia, we learn from information supplied by Mr. E. Buckmire, Agricultural Assistant in that island, that most of the leather used by the shoemakers there is locally tanned, but that the quality is inferior to imported leather in durability and resistance to wet.

Mr. Buckmire reports that the tanning industry in St. Lucia has been gradually developing for more than twelve years, and that skins are now being tanned in almost every district of the island, but in no case is it carried on as a man's sole occupation, nor is there any regular tannery. The bark of the mangrove is the usual material employed in the process, and sometimes also the bark of a tree known locally and in some other islands also as 'Bois tan' (*Byrsonima spicata*).

It seems desirable that the tanning industry should be encouraged and developed; and for this purpose the improvement of the quality of the leather ought to be aimed at. In the first place the co-operation of individual tanners might lead to the construction of a properly equipped tannery, where competent workmen might obtain a remunerative wage, enabling them to devote their whole attention to their art.

In the second place, research might be made into local supplies of tanning material, for as is well-known, there are a number of indigenous or naturalized plants which are quite rich in tannin. Thus the quality of the leather might be so improved as to be able to compete fairly at a lower cost with that imported, and leather enough turned out to supply local needs, if not for export.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, Dceember 13

ARROWROOT—6*d.* to 7*d.*
BALATA—Venezuelan Block, 3/3¾ to 3/5½; Sheet, 3/9 to 4/-.
BEESWAX—No quotations.
CACAO—Trinidad, 99/-; Grenada, 96/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, 105/-
HONEY—Jamaica, 130/- to 135/- per cwt.
LIME JUICE—Raw, 2/- to 3/.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—4¼*d.*
RUBBER—Para, fine hard, 2/6¼; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., December 27.

CACAO—Venezuelan, $12·00 to $12·25 Trinidad, no quotations.
COCO-NUT OIL—$1·35 per gallon.
COFFEE—Venezuelan, 12c. per ℔.
COPRA—$7·70 per 100 ℔.
DHAL—No quotations.
ONIONS—$8·00 per 100 ℔.
PEAS, SPLIT—$12·00 to $12·50 per bag.
POTATOES—English, $4·50 to $5·00 per 100 ℔.
RICE—Yellow, $11·50 to $11·75; White, 9·50 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS. & Co., December 11

CACAO—Caracas, 12½c. to 13c.; Grenada, 12c. to 12¼c. Trinidad, 12⅞c. to 13c.; Jamaica, 9c. to 10¼c.
COCO-NUTS—Jamaica selects, $40·00 to $42·00; Trinidad selects, $35·00 to $38·00; culls, $20·00 to $30·00 per M.
COFFEE—Jamaica, 9¼c. to 11c. per ℔.
GINGER—16½c. to 21c. per ℔.
GOAT SKINS—Jamaica, 80c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 65c. to 70c. per ℔.
GRAPE FRUIT—Jamaica, $2·25 to $3·00 per box.
LIMES—$6·50 to $7·00 per brl.
MACE—32c. to 38c. per ℔.
NUTMEGS—18½c. to 21c.
ORANGES—$2·50 to $3·00.
PIMENTO—5⅞c. to 6c. per ℔.
SUGAR—Centrifugals, 96°, 6·70c; Muscovados, 89°, 5·86c. Molasses, 89°, 5·57c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., January 21.

ARROWROOT—$9·00 per 100 ℔.
CACAO—$12·00 per 100 ℔.
COCO-NUTS—$28·80 husked nuts.
HAY—$2·90.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations; Patna, no quotations; Rangoor, no quotations.
SUGAR—Dark Crystals $5·00.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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Farmyard and Other Manures.

IN an article under this heading, *The Field* of September 15, 1917, draws attention to a possible divergence of opinion between farmers and their scientific observers concerning the relative merits of farmyard and artificial manures; in this it states: 'There are two points upon which it looks as if practice and science were to come into conflict. The latter has a greater belief in the virtues of the concentrated artificial manures than the former. The farmer appreciates the qualities of artificials, but in his estimation, based upon personal experience and careful observation, they can be used to better advantage to supplement dung than to displace it. It will take a great deal to shake this conviction, for it is rooted in generations of careful study and practical achievement. The modern manufactures and natural materials of commerce have a very important province to fulfil, but there is proof both here and on the Continent, particularly in Germany, to show that continuous exclusive artificial manuring is detrimental to the health and ultimate productivity of the soil. This may be due to chemical action, but it is quite as likely to result from the absence of the beneficent influence of farmyard manure upon the physical state of the land. It is known that while concentrated fertilizers may, in certain circumstances, be more effective than dung in forcing crops safely through critical stages of development, and, used freely, will produce more vigorous growth than farmyard manure alone, the latter acts as a valuable corrective to weather extremes; it conserves moisture in dry seasons, and facilitates drainage when there is an excess of water in the surface soil. The confidence reposed in manure made in the yards, therefore, is firmly founded upon solid economic teaching coupled with practical attainments. . . . . Dressings of artificial manures may be added with varying advantage, often very great benefit, but animal manure should, wherever practicable, form the foundation in the general scheme of manuring land.'

As regards West Indian agriculture and the advice given by scientific advisers to planters, we think it may safely be asserted that this is mainly in accord with the view of the writer of the article quoted above. Here both scientist and planter realize the value, indeed the necessity, of using farmyard manure or its equivalent, though the advisers of the planters may at times urge that more farmyard manure should be used, that more effort should be made to increase the quantity that is available, and that greater pains should

be taken to conserve it so as to avoid waste of its valuable qualities.

As *The Field's* article indicates, farmyard manure performs two distinct functions: it provides material which acts, more or less directly, as food for the crop, and it exerts certain beneficial effects upon the soil. The former of these functions can be fulfilled to a very large extent by artificial manures, but the function of soil amelioration is largely confined to farmyard manure, or to the somewhat similar substances employed by way of 'green dressings'. The provision of decaying vegetable matter, to form what is familiarly spoken of as humus, is recognized to be essential to the production of fertile fields, and it is also acknowledged that this provision is even more necessary in the tropics than in temperate regions, on account of the rapidity with which humus decays and disappears under tropical conditions of heat and moisture.

At the present moment the difficulty of the West Indian planter lies in the fact that he is unable to obtain those quantities of artificial manures which practice has informed him to be desirable for supplementing the farmyard manure commonly used.

It is quite true that the employment of artificial manures is often regarded both in England and in the colonies as evidence of scientific agriculture, and so it is to a certain extent; it may be true also, that the undue or wasteful use of these manures often characterizes the less skilful planter, whose practical experience may not have kept pace with his theoretical ideas, but it cannot be said that scientific workers who have had much experience in the tropics underrate the value of farmyard manure, or advise planters to neglect its use in favour of artificials.

'The other point,' says *The Field*, 'upon which a division of opinion is probable is the influence of the ration upon the fertilizing value of the dung. Science appears to be changing its view in respect to this question. It has been suggested that existing beliefs concerning the fertilizing properties of manure made from stock fed liberally with meals and cake are not justified by actual results. The evidence upon which this far-reaching pronouncement is based has not yet been made known, but should this plea be seriously advanced, a sharp conflict with practical experience is assured. Farmers, who had the support of early scientists and many still living, hold decided views on the value of high feeding as a source of soil fertility, and, as a matter of fact, the whole system of farming is based upon the acceptance of this principle. There are not a few who believe that the present estimate is founded upon too generous a scale, but science will tackle a difficult problem if it should now set out to disprove what its earlier exponents and successive generations of competent farmers established as a fundamental condition in good husbandry.'

This question receives much less consideration in the West Indies than it does in Britain; it is perhaps a pity that it does so, for a fuller perception of the points at issue would lead to more careful conservation of the farmyard manure produced upon estates.

There is one point in connexion with the use of farmyard manure which may perhaps be worth raising at this point, and that is, the value of farmyard manure as a means whereby certain necessary beneficial bacteria are conveyed to the soil. It is probable that the beneficial effect of farmyard manure is largely influenced by the manner and the rate at which it undergoes change in the soil. The changes are, doubtless, largely caused by certain bacteria which have the property of decomposing the cellulose of the tissues of the vegetable matter existing in the manure. The necessary bacteria exist in the alimentary tract of the animals producing the manure, and continue their functions in the manure heap and in the field. In this way they help to render more immediately useful the tissues contained in the litter which forms a large part of most farmyard manure and the vegetable matter from other sources which is added to the soil. In this connexion the suggestion has been made that probably the addition of small quantities of farmyard manure, with its attendant bacteria, to the soil at the same time that green dressings are applied, will prove useful, the idea being that, in the event of there being a deficiency of these organisms in the soil, the green dressing will only become available at a slow rate, and so may fail in its efficiency, whereas the addition of the required bacteria may speed the process of decay, and so hasten and increase the activity of the green dressing.

It is probably on account of this bacterial action that planters prefer, when possible, to put the extra material in the way of bush, grass, and the like, into the pens to mingle with the farmyard manure, rather than to bury it directly in the land. It would be a useful matter for experiment, to determine whether similar useful action will go on in the field if additions of farmyard manure are added to green dressings. If this is the case, it may possibly lead to an increased use of the practice of green dressing, which appears to be suffering some neglect.

BENGAL BEANS IN MONTSERRAT.

Experiments have been made at the Botanic Station in Montserrat with species of Stizolobium (Mucuna), in order to discover a reliable type which can be used as a stock food, and, in conjunction with pigeon peas, be grown as a rotation crop with cotton. A sample of the beans was sent to the Imperial Institute for examination, and a report on the sample was returned to Montserrat, and embodied in the report of the Agricultural Department of that island for the year ended March 31, 1917, which has just been issued.

As these beans are being experimented with in other islands also, the report which is quoted in extenso below will doubtless be of value and interest.

'The sample consisted of flat beans of a roundish rectangular shape, and of a light greyish-ash colour with very faint marking, and a prominent cream-coloured hilum. The beans had a thin, tough, outer coat, and a firm buff-coloured interior.

RESULTS OF EXAMINATION.

	Present sample, per cent.	Lyon or white velvet beans from Nigeria, per cent.	Lyon or white velvet beans from Nyasaland per cent.	Bengal beans from St. Vincent, per cent.
Moisture — —	10	7·2	9·7	13·8
Crude proteins —	24·8	24·7	25·1	25·8
consisting of				
True proteins —	21·8	22·3	21·3	22·5
Other nitrogenous substances—	3·0	2·4	3·8	3·3
Fat — — —	3·9	3·9	3·3	3·5
Starch, etc. (by difference) —	51·5	55·4	51·0	48·8
Fibre — — —	6·3	5·4	7·8	4·9
Ash — — —	3·5	3·4	3·1	3·2
Nutrient ratio —	1:2·4	1:2·6	1:2·3	1:2·2
Food units — —	123	127	122	122

'No alkaloids or cyanogenetic glucosides were detected in the above samples.

REMARKS.

'These beans are similar in composition to Bengal beans, and also to the Lyon or white velvet beans from Nigeria and Nyasaland referred to in the above table and previously examined at the Imperial Institute, and which were identified at Kew as *Mucuna nivea* (*M. Lyoni* or *Stizolobium niveum*). They resemble the latter in appearance, but are more elongated in shape, and the veins on the seed coat are less conspicuous.

'There is some conflict of opinion as to whether *Mucuna nivea* beans are suitable for food, though Lyon beans are stated to be eaten with great relish in the United States. The green pods of this species, moreover, are stated to be eaten in India as a vegetable, the outer velvety skin of the pods being removed before cooking Some confusion exists as to the identity of the various species of Mucuna beans, and though velvet beans have been used as human food by natives in Nyasaland, it is not quite clear whether the white beans (*M. nivea*) or the black beans (*M. aterrima* or *Stizolobium aterrimum*) or both varieties are so employed.

'The Imperial Institute communicated with the United States Department of Agriculture on the subject in 1916, and in reply the Department stated that they had no information that *Mucuna nivea* beans were harmful, and pointed out that there had been frequent favourable reference in the Annual Reports of the Florida Experiment Station to the use of the beans for feeding domestic animals, and no allusion to any harmful effects when they were used for this purpose.

'The United States Department of Agriculture also referred the enquiry to Professor Rolfs, who was responsible for a statement that the beans had caused unpleasant effects in human beings. In his reply Professor Rolfs stated that feeding experiments with cattle and pigs have given convincing proof of the value of the beans as a feeding stuff for farm animals, and further, that the beans have been used by whites and black labourers in Florida, and that the only complaint made was that the flavour was not good. He added that persons who used them in a trial which he arranged, felt certain ill effects, though they did not regard them as serious.

'All the samples of these beans received at the Imperial Institute, including that now under report, have been carefully examined for alkaloids and cyanogenetic glucosides, and no traces of constituents of either type have been found in any of the samples. Similarly, extracts of the beans have been prepared by processes designed to concentrate in the extracts deleterious substances of any type likely to be present in the beans, and no indications have been found of the presence of any poisonous constituent.

'The position therefore is that, as regards the varieties of *Mucuna nivea*, there is a considerable body of evidence that they have been used as food for human beings in the United States, Nyasaland, India, and elsewhere, and also as a feeding stuff for animals without causing ill effects. Further, numerous independent analyses of the beans have been made, and no indication of any deleterious constituents has been found. The suspicion that has been cast on the suitability of the beans as a foodstuff is due to the results of a single trial arranged by Professor Rolfs, and it will be seen from the remarks of this investigator quoted above that he does not attach final importance to the results of this trial, in view of the general experience in the United States that the beans are wholesome.

'While therefore further trials of the beans as a foodstuff seem to be needed, the bulk of the evidence available indicates that they are wholesome, and certainly justifies cautious trials of them as a feeding stuff for animals if not as a foodstuff for human beings.'

We reproduce the following from *The Times* of November 20, 1917: 'Sir Arthur Yapp who presided yesterday at Grosvenor House at a Conference arranged to disseminate information on the food value of potatoes said that, after providing for the normal consumption, there was a surplus of considerably over 2,000,000 tons of potatoes, which if used during the next six months—a most critical period—instead of bread, would save half a million tons of flour, equal to 330,000,000 bread rations, which was sufficient to keep the whole of the United Kingdom in bread for two months. He urged the necessity of breaking more ground for potato growing. Dr. Campbell, who has made a special study of the potato question, stated that arrangements had been made for the starting of mills for producing potato flour in the New Year.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. The notes of the Superintendent of Agriculture, Mr. J. C. Moore, for the months of October, November and December, which have now come to hand, disclose a continuation of work of a general routine character in the Experiment Stations and Botanic Gardens during the period covered. Plant distribution was as follows: for October and November—8,600 lime plants, 150 cacao, 17 budded orange, 11 grafted mango, 94 timber trees, 83 ornamental plants, 7 various, and 15,000 potato cuttings; for December—85 cacao plants, 4 mango, 29 ornamental, and various seeds.

The gathering of the cacao crop, commenced in October, was in full swing in December, but is expected to be below the average. The nutmeg crop is reported as normal, while the lime crop is said to be smaller than that of last year. The sugar crop was satisfactory. Provisions were plentiful. The corn crop was good on the whole, and one of the largest on record. The second crop was fairly promising. The dry weather in November affected the young plants adversely in some places. Thrips has shown considerable development in some places, and has become locally severe.

The weather during October was normal, the rainfall recorded at Richmond Hill being 7·92 inches. November was unusually dry, only 6·54 inches of rain being registered at Richmond Hill. December was showery up to the last week, when heavy rains fell, the precipitation at Richmond Hill being 7·08 inches.

ST. LUCIA. Mr. A. J. Brooks, Agricultural Superintendent, reports the following plant distribution during the month of December: limes, 2,500; grape fruit, 18; budded oranges, 10; grafted mangoes, 2; cacao plants, 70; coffee, 50; ornamental plants, 9. There were also distributed 120 packets of vegetable seeds. The wooden bridge in the Botanic Gardens is being replaced by a concrete bridge which is raised 3 feet above the former level. A large mahogany cabinet made from trees grown in the Gardens was completed and placed in the central office, and now houses the 'Kennaway Collection of St. Lucia Birds'.

The cacao crop is reported as good; limes second crop, heavy; sugar, fair. Experiments on a commercial scale were carried out at Réunion during the month in connexion with the manufacture of farine, starch, and potato chips and flour.

The rainfall registered at the Botanic Gardens, Castries, during the month was 7·95 inches, and at the Agricultural and Botanic Station, Choiseul, 2 39 inches.

VIRGIN ISLANDS. In his notes for the month of December, Mr. W. C. Fishlock, Curator, Tortola, mentions work chiefly of a routine nature, carried on in the Experiment Stations. Plant distribution was as follows: onion seedlings, 21,000; potato cuttings, 1,000; coco-nut plants, 31; cabbage plants, 16; decorative plants, 19; cotton seed, 30½ lb.; vegetable seeds, 13 packets.

The cotton cultivation appeared to be in fair general condition; the same is said of ground provisions. In regard to the cotton industry it is mentioned that the prevailing high prices and the payment of the bonus on the 1916-17 crop have had a stimulating effect. Cotton worm has been troublesome in some districts, notably West End, and there has been some enquiry for Paris green.

Weather conditions during the month were abnormal: strong northerly winds alternated with calms. The nights were often exceptionally cool. The month was dry. Rain fell in measurable quantity on sixteen days, the total precipitation being 2·55 inches as compared with 5·51 inches, the average for the month for the past sixteen years.

AGRICULTURE IN BARBADOS.

We do not think that the same difficulty is being experienced in establishing the young cane crop as was the case at this time last year. We have observed that the supplies have grown with a good deal of regularity. This is doubtless due to the effect of the heavy rain on Christmas Day. When plants are already in the soil, a rain has a much better effect on them than if they are planted after a soaking rain, with two or three weeks of dry weather succeeding.

The majority of fields are growing well, and, given moderately showery weather during the next fortnight, the crop for 1919 will have been established. The fact that but comparatively few shoots are to be seen in some fields does not mean that the plants are dead. The recent rains will cause many a cutting to come up.

A start is being made with the reaping of the cane crop for 1918. Only a few factories are ready for grinding, and not even all of these have started operations. A good many windmills and a few steam mills are engaged in making syrup, and some of these would not have been yet at work but for incendiarism.

We learn that the juice is somewhat richer than was anticipated. In a few districts the density is 10°, in most districts 9°. The B.376 is at this stage sweeter than the new seedlings, and the earlier it can be reaped the better; for already a few rotten canes and many canes which have recently lost their tops are being found in each load as it is overturned in the mill yard. This is not, so far as we have been able to observe, the case with the new seedlings. Beyond having been checked in development by the unfavourable weather of the past four months, they show no signs of depreciation of any kind. The tonnage of the first few acres of plant canes on an estate in St. George's parish has averaged between 30 and 35.

It will be observed that the factories have not made as early a start as last year. This is due not only to the fact that the crop in most districts is not as mature as at this date last year, but also to the delay in the completion of improvements of various kinds at almost every factory.

The recent rains have enabled planters to sow potatoes. We know that in many districts this was done without delay, and we hope that this has been the case everywhere. Every class of the community should realize the gravity of the present crisis, and do its part—the planter, the peasant proprietor and the labourer.—(*Agricultural Reporter*, January 26, 1918.)

AGRICULTURE IN JAMAICA.

The Governor of Jamaica in his report on the colony for 1916-17, issued as *Colonial Reports*—Annual, No. 943, states that: 'The chief feature of the year in relation to the agricultural interests of the colony was the hurricane in August which practically swept the whole island from East to West, so as to destroy the whole banana crop, and to do a good deal of damage to coco-nuts, canes, and cacao. For so serious a disaster to occur two years in succession has been a heavy blow to the banana industry. Owing to war conditions, other staples, such as sugar, rum, logwood, cacao, annatto, ginger, orange oil, and hides have sold for high prices, and

it is now evident that but for the hurricane, the exports of Jamaica for 1916 would probably have created a record in the history of the trade of the colony.'

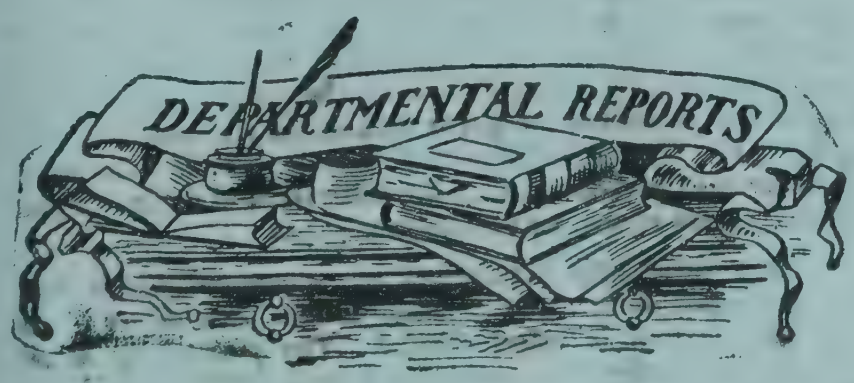
It is noted that the revival of the sugar industry is now being prosecuted, and with an Imperial market for its produce, this industry will probably be conducted with enterprise and success, wherever conditions in the island are favourable.

With regard to the banana industry, the report mentions that: 'The incidence of Panama disease of bananas during the year has shown a marked reduction, only 163 diseased plants having been reported on forty separate spots, or an average of four plants per base. This disease is a very difficult one to control, but where the strict measures of quarantine provided under the Law have been successfully enforced, the results have been satisfactory, and with care and watchfulness there is no reason for the planters of Jamaica to view this disease with serious apprehension. It has been demonstrated, however, that infected land appears to remain permanently unfit for the cultivation of the "Gros Michel" or "Jamaica banana", although the "Chinese" or "Canary" variety has been found to be immune to the disease.'

In spite of some alarm at the discovery that the black weevil borer of bananas was somewhat widely spread over three parishes of the island, it is now considered that this insect is not a very serious pest where bananas are well cultivated.

In conclusion, the Governor remarks: 'The high prices of imported foodstuffs, and the uncertainty as to their supply, in view of the shortage of shipping and the demands of the Allies in Europe, rendered it advisable to take steps to urge the planting of ample foodstuffs in the island, to render the population independent of an imported supply, should there be any failure in that supply.

'The measures taken have ensured that, if supplies from outside are obtainable in decreasing quantities, there should be ample food for all, and it is stated that never before have such quantities of provisions been planted out as during the year under review. It has furthermore been generally impressed that the present situation will not be confined to the period of the war alone, but that it appears to be increasingly probable that for some time after there will be a world-wide shortage of food for man, and that surplus supplies may be in great demand.'



BARBADOS: REPORT ON THE DEPARTMENT OF AGRICULTURE, 1916 17.

This report, issued as a supplement to the *Official Gazette*, January 24, 1918, has just been received.

Naturally much space is devoted by the Superintendent of Agriculture, Mr. J. R. Bovell, I.S.O., to details in connexion with sugar-cane experiments. These, however, have been previously issued in a separate report, which has been already referred to in this Journal (Vol. XVI, No. 407).

Following the portion of the report on sugar-cane comes that dealing with the cotton industry. The experiments with this crop are carried out, it is stated, in two series. 'In the first series an effort is being made, by a selection of the best formed plants giving heavy yields of good quality lint, to improve the Sea Island, certain indigenous, and other varieties of cotton. In the second series an effort is being made in the same manner to improve a number of hybrid cottons that have been obtained by crossing some of the improved varieties with some of the indigenous cottons.'

With regard to Sea Island cotton, seed of a special strain, obtained by selection over several years, was distributed to nine planters for experiment under field conditions, but accurate returns both of the yield per acre and of the quality as tested in England are not available.

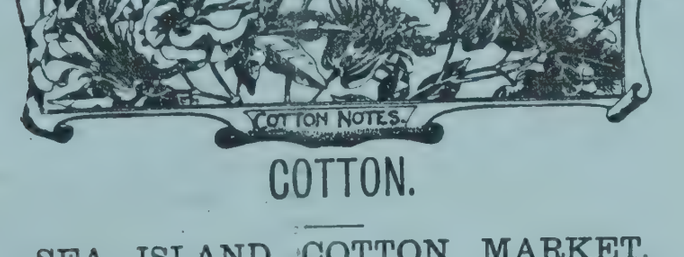
By indigenous cottons Mr. Bovell means varieties that have survived in the island from former times when cotton was grown here on a commercial scale. Attempts are being made to improve some of the best of these. The improvement seems to be a slow process, but Mr. Bovell states that some of the varieties have already greatly improved, and seem 'practically free from insect pests and fungoid diseases.'

In addition to these indigenous cottons there is a cotton obtained from Dr. C. E. Gooding who had grown it from seeds of a wild cotton, which so far has kept true to type. This cotton has also been up to the present practically immune from disease, and the quality of the lint is said to be improving under cultivation.

With regard to food crops, experiments are made by the Agricultural Department, Barbados, as by other agricultural departments throughout the West Indies, on several of these crops. With regard to cassava, experiments are continued with varieties obtained from different countries, as well as with a number of seedling varieties obtained in previous years from the cassava under cultivation in Barbados. Three of these Barbados seedlings have continued to give good results for four years of cultivation. A useful item of knowledge has been verified by the experiments on tanias and eddoes. It seems definitely reliable that better results are obtained when corms are used in planting tanias, than when rhizomes are so used. The contrary however is the case with eddoes. We note that Mr. Bovell speaks of eddoes as Caladiums. Several writers, however, in publications of the United States Department of Agriculture, prefer the generic name Colocasia; the Caladiums are said to be of little or no economic value. Experiments on yams include not only local varieties, but also some from Dahomey. The return per acre for six years from the Lisbon yam has been an average of 14,677lb., by far the largest average yield of any variety experimented with. Mr. Bovell thinks highly of the properties of *Panicum divaricatissimum*, a closely related species to Guinea grass, as a fodder grass, and hopes that it will be successfully introduced into the island.

The list of plants at present in the herbarium of the Department of Agriculture, Barbados, is appended. Attention must be drawn to what is an evident mistake, by which two cottons, namely *Gossypium barbadense* and *G. herbaceum*, together with *Thespesia populnea*, belonging to the order Malvaceae, and *Adansonia digitata*, belonging to the allied order Bombaceae, are classed under the unrelated order Capparideae.

The portion of the report dealing with the insect and fungus pests prevalent in Barbados will be dealt with in another issue.



COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended January 5, 1918, is as follows:—

ISLANDS. We have had a dull market throughout the week, and all business has been more or less suspended by unprecedented cold weather

The Exchange reports no sales.

The Factors are still refusing to make any concessions to sell, and are holding for prices last quoted. However, the offering stock is increasing, and with orders in hand we can buy to advantage, having a good stock to select from.

We quote, viz:—

Fine to Fully Fine 73c.=75c. c.i.f.

Fine to Fully Fine, off in preparation, 70c. to 71c.=72c. to 73c. c.i.f.

GEORGIAS AND FLORIDAS. The market in Savannah and the interior towns has been very quiet throughout the week, with limited demand resulting in small sales. All the offerings are firmly held at our quotations, and there is a general feeling among all holders of cotton that the limited supply will be required, and that the mills in the near future will resume purchases.

We quote, viz:—

Extra Choice to Fancy	73c.=75c. c.i.f.
Average Extra Choice	73c.=75c. ,,

The exports from Savannah for the week were, to Northern Mills 72 bales, and from Jacksonville to Northern Mills none.

WASTE PRODUCTS OF CANE-SUGAR MAKING.

In an article in the issue of this Journal of January 12, it was suggested that although good work was now being done in the matter of extraction of sugar from the cane in some of the smaller West Indian islands, it would probably be advisable in the future to devote more attention to what may be called the waste products of the sugar industry, if this industry is to continue to be remunerative here.

That this question is engaging much attention in larger sugar-growing countries was evidenced by the report of the standing committee of the Louisiana Sugar Planters' Association, some of which was reproduced in the same issue of this Journal. The subject is again dealt with in a paper in the *Louisiana Planter*, December 29, 1917, continued in the number for January 5, 1918, by Dr. W. E. Cross, who is now the Director of the Sugar Experiment Station at Tucuman in Argentina. This paper was written some years ago, but it has been brought up to date by Dr. Charles E. Coates, and it is thus published. It is not only a very interesting study of the question, but also seems to suggest developments in this direction. A résumé of it, therefore, will possibly be of utility to West Indian sugar manufacturers.

Much remains to be accomplished in the utilization of the waste products of the manufacture of cane sugar, one reason perhaps being that the haste and hurry of the reaping season is such as to leave little opportunity of dealing with other things than the chief product, the sugar itself, and perhaps the molasses, which is rather a by-product than a waste product

These waste products of cane sugar making are (1) the tops and trash, (2) the megass, (3) the filter-press cake. The first of these is utilized in the West Indies probably in the same way as has always been done; the tops are used as fodder, and the trash is utilized as litter for estate animals, or as a mulch on the fields. That the tops might be more economically used for the same purpose as at present by a more general employment of silos is probably true; but whether for tops and trash more profitable uses could be found is at least doubtful at present, although the possibilities with regard to megass may apply to a lesser extent to the utilization of the trash also

The use of megass to supply the necessary fuel for the factory appears not only to be essential but economical in these islands, where other fuel is scarce or expensive. Yet in well managed factories there is quite a considerable amount of megass remaining after all the fuel necessities have been met.

Hitherto all attempts to utilize megass for other than fuel purposes have been in the direction of paper making, but with no conspicuous success. Apparently this idea was first started in Guadeloupe as far back as 1872. Since then it cannot be said that any factory, up to 1912 at least, has been able to conduct paper making from megass as a commercial success. The most hopeful undertaking in megass paper seems to be that of mixing megass pulp with other substances such as grass, wood, bamboo, etc. This was done, it is said successfully, a couple of years ago at a factory in Trinidad. At Nipe Bay, Cuba, extensive experiments have also been made in this direction, and paper made of a mixture of megass pulp and wood was of excellent quality. The paper-making plant was burnt down in 1916, but it is reported that a new plant for the purpose is to be built this year for operation during the next sugar-making season

The Searby shredder, to which attention was drawn in the issue of this Journal for December 1, 1917, is said not only to increase the percentage of the extraction of juice from the cane, but also to reduce the megass to such an admirable condition for paper making that it seems a pity to burn it. The extended use of this machine in cane-sugar factories may perhaps lead to the utilization of at least a part of the megass in the manufacture of paper

Two other uses for megass are suggested which may be developed in the future. One is as a raw material for the manufacture of ethyl alcohol. The process by which cellulose is dissolved in concentrated cold sulphuric acid, and then hydrolized to glucose, is in successful operation in several factories in the United States, sawdust and waste wood being employed as the raw material. The similarity in composition between sawdust and megass would indicate that the latter ought to be just as good a material for the process as the former Indeed the porosity of megass should be so advantageous as to make it possibly the better material of the two for the purpose.

A second suggestion is the employment of megass for distillation. Fair profits are made in various countries from

the distillation of different woods, by which wood alcohol, acetone, acetic acid, and various oils, etc., are produced on a commercial scale. It is possible that megass, subjected to the process of dry distillation, would give products of such value as to justify the commercial exploitation of the idea. The writer of the article in the *Louisiana Planter* states that he has conducted preliminary experiments with megass on these lines, by which methyl alcohol, acetic acid, and acetone were indentified among the products obtained, which also included a tar of a peculiar odour, which has not yet been fully investigated.

The third waste product of the cane-sugar manufacturer is the filter-press cake. The composition of this cake varies very considerably with the method of clarification. In every case however, wax is an important constituent, being present to an extent of up to 12 per cent. of the dried cake. This wax can easily be extracted by boiling the dried cake with organic solvents like alcohol, naphtha, etc. The extract thus obtained is filtered off and, after evaporation, cooled as a yellowish white mass.

Very considerable attention has been given to the possibility of extracting this wax on a commercially profitable scale. As was noted in the issue of this Journal, January 12, the question has been taken up in the Natal sugar factories. Samples of Natal sugar-cane wax shipped to England have been examined at the Imperial Institute, and found to be of good quality, so that it could be used as a substitute for Carnauba wax. The industry has been started on a small scale in Natal. One difficulty in extracting the wax is the danger of fire, due to the use of alcohol or gasolene in the process of extraction. This however is overcome by the use of non-inflammable carbon tetrachloride. The wax is said to be probably worth 20c. to 25c. a lb. The other ingredients of the filter-press cake do not offer any prospect of economical extraction. The profitable utilization of filter-press cake itself is also receiving attention. It is used at present to some extent as a fertilizer. The filter-press cake is also used as a valuable food in the West Indies for estate animals, and after it has been eaten by the stock a large proportion of its contents of mineral value will be recovered in the pen manure. Its high lime content probably causes benefit to the soil from its use, and the small quantities of phosphate and nitrogenous matter it contains are undoubtedly of some fertilizing value. Another use has been recently suggested from Java. It is suggested that the filter-press cake should be burned—that is to say, charred—and that this should be used instead of bone black for the decoloration of the juice.

It is thus evident that in several directions research is being made for the utilization of hitherto waste products of cane sugar manufacture.

CANE FARMERS.

The *Louisiana Planter*, December 15, 1917, contains an article on this subject, more particularly with reference to conditions in Trinidad. The matter is of so much importance to the sugar industry everywhere that the article in question will be of general interest.

'As the island of Trinidad is becoming of increasing importance in the cane-sugar world, its present output reaching 70,000 tons per annum, and still larger results are promised within a few years, the data that come from that island are of importance to all persons concerned in cane sugar anywhere. In reviewing in this Journal some months ago the official report of the Agricultural Department of Trinidad and Tobago on cane farming, we were surprised to see the increasingly large amount of cane coming from the cane farmers. The sugar industry of Cuba could never have attained the proportions that it has done had it not been for the cane farmers or colonos, as they are termed on that island. Some of these colonos are experienced sugar planters of the old muscovado days, who found that they could now do better by selling their canes to the new great central factories than they could by continuing in the old lines. In fact, the central factory idea has come to stay, and has practically supplanted the old-fashioned sugar planter who grew his own cane, and made the cane into sugar.

'In referring to the work done in Trinidad, we adverted to the fact that the great St. Madeleine central factory there was reporting a larger number of tenants than formerly. Our intention was simply to show that the cane fields and the cane factories were two separate establishments, and that the modern tendency was to identify the tiller of the soil with the work that he was doing, and in this way to secure the highest degree of efficiency from the individual man, if such efficiency be procurable by any means.

'The point thus under consideration, and which we believe will be under very serious consideration in all the West Indies before many years, is as to where the factories shall get their sugar-cane.

'The underlying principle in the whole matter is to secure piece work, so that the individual will learn that each effort he makes is for himself, and that even while he may be employed by a great factory, or by some single sugar planter, the work that the employee does as an individual, is for his own account. If the cane farmer be ambitious he will endeavour to utilize every moment of time and all the knowledge that he has in the successful production of his crop.

'Of course, the cane farmer on his own land, free and independent and not in need of any financial relief, might be careless without injuring anyone excepting himself. At the same time, if he or such men as he were the main dependence of the sugar factories, they would necessarily be seriously damaged by the carelessness on the part of all of these farmers.

'But we find that the East Indian government has been discouraging the migration of the coolies to the West Indies, and that the labour supply in Trinidad, as well as elsewhere has been seriously impaired, and the matter of human labour is now becoming a very serious one throughout the cane-sugar world.

'They are beginning to feel the scarcity of labour in Cuba at the present time. In the implement world every effort is making to produce agricultural tools that will reduce the call for human labour down to a minimum. All the world seems to be bent on utilizing this idea, and we are reaching an age in which the application of mechanical power is ranking higher and higher every day.

'As the years roll around us, and as labour grows scarcer, the conditions presented thrust new problems out for solution, and cane farming is one of the present solutions that is producing in Louisiana and in Cuba about half of the canes produced in these two countries, and is gradually progressing throughout the cane-sugar world.'

From official returns which Mr. J. R. Bovell, I.S.O., the Superintendent of Agriculture, Barbados, has forwarded, it appears that 1,337 acres are under Sea Island cotton cultivation in that island, 21 acres of which are cultivated for a second crop. Practically the whole of the cotton area is in the drier parts of the island, 1,042 acres being in St. Philip and Christ Church, the south eastern dry district, and 177 more in St. Lucy, the dry northern parish.

EDITORIAL NOTICES.

Head Office — Barbados.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies — Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor — W. R. Dunlop.*, Rev. C. H. Branch, B.A.

Entomologists — H. A. Ballou, M.Sc.†, J. C. Hutson, B.A., Ph.D.

Mycologist — W. Nowell, D.I.C.

Assistant for Cotton Research — S. C. Harland, B.Sc.††

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Typist — Miss B. Robinson.

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Assistant for Publications — A. B. Price, Fell. Journ. Inst.

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†*Seconded for Duty in Egypt.*
††*Provided by the Imperial Department of Scientific and Industrial Research.*

Agricultural News

Vol. XVII. SATURDAY, FEBRUARY 9, 1918. No. 412.

NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue deals with the value of farmyard and other manures, especially when used in combination.

Under Insect Notes, on page 42, will be found an account of the sweet potato root weevil, a closely related pest to the scarabee of these islands.

A fungus disease affecting many species of trees is the subject of a note under Plant Diseases, on page 46.

An article on page 38 draws attention to the possible utilization of the waste products in the manufacture of cane sugar.

Pollination of Coco-nut Flowers.

According to a paper on coco-nut experiments, contributed to the *Agricultural Bulletin of the Federated Malay States*, July 1917, by G. E. Coombs, Economic Botanist, and W. S. Cookson, Manager of Dindings Estates, the average loss in a year's crop of four to four-and-a half-year-old palms, which is due to undeveloped nuts falling off, is from 50 to 60 per cent. The authors place such losses in the following categories:—

(a) Nuts which are unpollinated, and therefore unfertilized;

(b) Nuts which are pollinated, but in which fertilization does not take place;

(c) Nuts which are pollinated and fertilized, but which are thrown off from physiological causes, because of the trees' inability to carry them. Nutrition factors, water-supply in particular, here play an important part, and may possibly largely determine periodicity in crop production.

The probability is that the overwhelming majority of these falling nuts are those under category (a), in which pollination is never effected.

The coco-nut flower is pollinated both by insects and by wind. As an insect flower, however, it falls short of the general attractive mechanisms of scent, colour, and amount of nectar produced. As a wind flower, it lacks the generally present pendulous stamens, the much expanded stigma, and other characters, though it produces a quantity of smooth pollen. Some experiments on hand pollination are being now conducted in Ceylon, with a view to finding out whether the number of falling nuts can be thus reduced.

Machines for the Treatment of Cotton Seed against Pink Boll Worm.

In *Bulletin No. 14* of the Technical and Scientific Series of the Egyptian Ministry of Agriculture, Mr. G. Storey discusses the general nature and action of the machines which have been proposed for the treatment of cotton seed in order to kill pink boll worms therein, and to render the seed safe for distribution for planting, and generally innocuous as regards the dissemination of the pest.

The machines which are the subject of the bulletin are of two kinds, those which attempt the destruction of the pest by means of poisonous gases, and those which seek to attain this end by means of heat.

The bulletin contains an interesting discussion of certain fundamental principles which must be attained if the machines are to prove effective. As regards machines employing poisonous gases, it is pointed out that it is essential that these gases must reach every part of the material under treatment if they are to be effective. It would seem that this is not so readily achieved as might be expected, for even in machines in which a vacuum is created, and into which hydrocyanic acid is subsequently admitted, it was found that this gas did not readily penetrate

hick layers of cotton seed, the reason being that the gas is absorbed to a considerable extent by the seed tself, whereby its deep penetration is checked.

In machines operating by means of heat it is found that marked irregularities often exist as to the temperatures to which the seed is heated in different parts of the machine; some of the seed may be insufficiently heated, while some of it may be over heated.

Where it can be certain that the temperature is actually applied, it would seem that an exposure to a temperature of 52°C. for five minutes is sufficient to kill the pink boll worm; while the seed will bear heating to about 60°C. without loss of germinating power.

Five types of machines for the use of poisonous gases are discussed, and fifteen machines making use of heat.

Tomatoes and Asparagus in Guadeloupe.

According to notes on kitchen gardens in the *Bulletin des Chambres d'Agriculture de la Guadeloupe el Dependances*, October 1917, the same tendency to degenerate is found in tomatoes there, when continuously planted from seed, as is experienced in most of these islands. It is however possible, the writer says, to graft tomatoes on what is known in Guadeloupe as 'bellangere batarde' (*Solanum torvum*) which is called in some of the English islands turkey berry. This grafting is productive of good results, inasmuch as the grafted plants continue for a long time to bear fruit of the original large varieties. The idea is worth being put into practice elsewhere.

It is interesting to note that asparagus is successfully grown in Guadeloupe. The bulletin quoted above states that in five months the shoots are as large in Guadeloupe as they are in France after a year's growth.

An asparagus bed well cared for bears all the year round in Guadeloupe. The great point is to choose light soil, well drained, and to till it well to the depth of from 70 to 80 centimetres. The method of cultivation advised is to make a trench 1 metre in breadth, digging out the earth to a depth of 60 cm. At the bottom is to be placed a layer of sticks cut from any easily obtainable wood. On them a layer of well rotted manure is spread and pressed down. In three lines, at a distance of 25 cm. from one another, also at distances of 25 cm. apart, basketfuls of good mould are turned over, and on each such heap is placed an asparagus plant, its roots being carefully spread out in order that they may take good hold of the soil. The plants are then covered with mould to a height of 10 cm., and the trench is then filled with the earth taken from it. Three or four a times a year a layer of well rotted manure should be applied to the bed. The asparagus bed should be completely cleaned in July or August by cutting down all old shoots and covering with a layer of mould from 5 to 6 cm. in depth, with the addition of a little chemical fertilizer.

If this most delicious vegetable is successfully grown in Guadeloupe, it is well worth trying in other lands. Seeds or roots are obtainable from any reliable seedsman in Europe or the United States.

Queensland Sponges.

The natural resources of Queensland exist in the sea as well as upon the land. The great reef which skirts the northern sea-board of Queensland is the home of the commercial sponge, the trochus shell fish, the bêche-de-mer, and other things which a more systematic or scientific search might reveal. So far, the growth of sponge has not been exploited, but trochus shell to the value of 30,000 has been exported to Japan from North Queensland. The luggers fish consistently and effectually. What is required is (1) a greater first-hand knowledge of the resources of the barrier and its environs; (2) a more stringent enforcement of the licensing laws; (3) the necessity for a close season in various sectors of the waters; and lastly, the introduction of scientific methods for development and control. It is interesting to note in connexion with this last proposal, that in Florida, U.S.A., a sponge farm has been successfully inaugurated, and sponges to the value of £40,000 are about to be put on the market. The way was made clear for this achievement by the American Bureau of Fisheries, an institution which is doing, in conjunction with the American Bureau of Standards, monumental research for American industry. The sponges are separated into tenths, and secured by platinum wire to small slabs of cement, which are 'planted' in a water vat selected for the complete absence of fresh water, protection from marauders, and freedom from sand. The marine produce of the Great Barrier Reef off the coast of North Queensland furnishes raw material for many industries. (The *Chamber of Commerce Journal*, December 1917.)

A Mud-Binding Grass.

There are many aquatic and waterside plants, whose roots, stems, and leaves arrest the removal of soil, etc., by water, and, by the accumulation of solid matter brought down by streams, build up as it were a foundation on which other plants obtain a footing, so that in time what was once swamp may be changed into forest.

According to *The Field* for November 17, 1917, a plant of this nature has become established about the shores of Southampton water. The grass has been identified at Kew as a species of Spartina, and is now known botanically as *S. Townsendii*. It is a vigorous, stout, stiff grass, about a yard high, forming close tufts more or less circular in outline, the tufts measuring anything between 3 feet and 15 feet across. It is supposed to be of hybrid origin, but is just as likely to be a sport or variation from *S. stricta*. The copious system of roots and stolons of this grass must contribute to the stabilization and solidification of the mud. In addition to this binding action, the stems and leaves act as a very effective strainer on the water, which is charged with solid particles brought down by the streams, catching and precipitating them. The result is an accelerated and increased deposition of mud over the area tenanted by the grass. The level of the mud bank becomes raised, the mud itself firmer. If the process continues, the muddy foreshore will gradually be replaced by terra firma

INSECT NOTES.

THE SWEET POTATO ROOT WEEVIL.

Although the above insect, which is known by the scientific name of *Cylas formicarius*, has not so far been recorded from the Lesser Antilles, it is well known as a pest of the sweet potato in Jamaica, Cuba, Porto Rico, British Guiana, and the Bahamas. This insect also occurs in several other parts of the world, and is considered to be of oriental origin. It was first noticed in the United States about forty years ago near New Orleans, whence it has spread to the other Gulf States and to the West Indies. This weevil is quite distinct from the scarabee or Jacobs which is found attacking sweet potatoes in some of the Lesser Antilles, but the damage done by the two weevils is similar, and any measures taken to control the root weevil would also be applicable to the scarabee. A somewhat detailed account of *Cylas formicarius* appeared in the *Agricultural News* for April 24, 1915 (Vol. XIV, No. 339), but in view of some recent investigations on this pest in Florida, it may be of interest to give a few additional notes on the subject.

Some of the latest information on this weevil, as it occurs in the Gulf States, is given in the *Quarterly Bulletin of the State Plant Board of Florida*, Vol. II, No. 1, by Wilmon Newell, the Plant Commissioner, and it is from this article that the following notes are mostly taken.

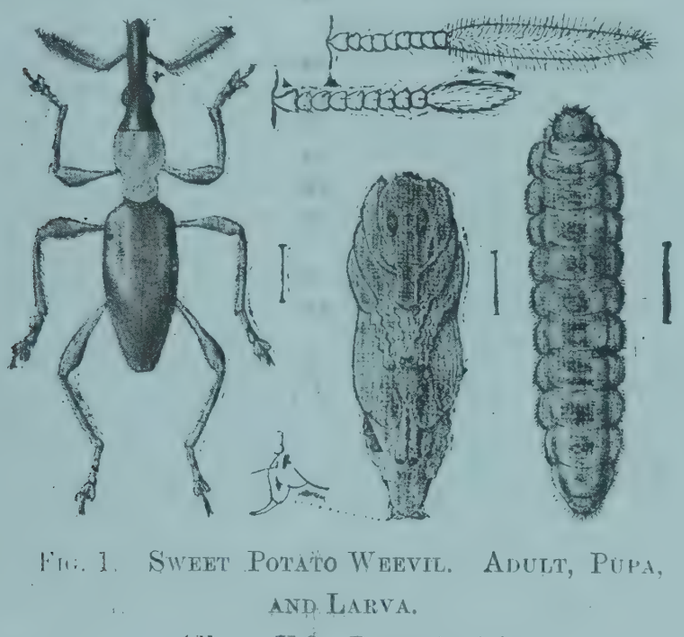


FIG. 1. SWEET POTATO WEEVIL. ADULT, PUPA, AND LARVA.

(*From U.S. Dept. Agric.*)

DESCRIPTION OF THE INSECT. The adult weevil is a small ant-like insect about a $\frac{1}{4}$-inch long, with a smooth, shiny body. The head is black, and is prolonged to form a beak, at the end of which are the biting mouth parts. The thorax (or middle portion of the body) and the legs are a bright brick-red, and the abdomen (or hinder part of the body) is a dark steel-blue. Although the adults possess well-developed wings they have rarely been observed flying.

LIFE-HISTORY. The life-history of this species has been worked out under Texas conditions by A. F. Conradi, with the following results. The very small yellowish white eggs are laid in cavities made by the female either in the tubers or in the vines, and a minute, footless grub hatches in from five to six days. If the egg is laid on the stem the emerging grub may sometimes merely tunnel in the stem and complete its development there, but more often it works its way down the inside of the stem to the tuber. Grubs hatching from eggs laid in or on the tuber itself bore into the tuber, and complete their development in about fifteen days, very quickly riddling the tuber with numerous tunnels which become filled with excrement and decaying matter. When full-grown the grub changes into a pupa, and the adult weevil emerges in about eight days. The whole development of the insect occupies from twenty-eight to twenty-nine days, and allowing a few days between the maturing of the adult and the laying of the first eggs, it will be seen that a complete generation can be produced in about thirty-five days. Since the weevil breeds continuously in the tropics, there is a possibility of ten or even eleven broods a year. It was found that the egg-laying period may continue for twenty-one days, so that there are no distinct generations, but weevils in all stages of development may be found almost any time. It will thus be seen that in the tropics this insect, with its powers of continuous reproduction and development, may be extremely destructive.

FOOD-PLANTS. The sweet potato (*Ipomœa batatas*) and the morning glory (*Ipomœa* sp.) are the favourite host plants, and the weevil eggs and larvae have been found on closely related vines. The adults, however, can feed upon a great variety of vegetation.

HOW THE WEEVIL SPREADS. The adult insect has only once or twice been observed in flight, and its slow rate of spread in a newly infested area shows that spreading by flight need hardly be taken into account. This pest is disseminated mainly by the movement of infested sweet potatoes and sweet potato plants from one locality to another.

NATURAL CONTROL. The sweet potato root weevil is remarkably free from natural enemies. No parasites have been recorded, and there is no mention in any records of birds destroying the weevils. Therefore reliance must be placed on artificial methods to control this pest.

ARTIFICIAL CONTROL. This includes quarantine measures to prevent the spread of the weevil to new areas, and direct methods to reduce damage in areas already infested.

A short outline of the quarantine measures adopted by the Plant Board of Florida to exclude the sweet potato root weevil was given in the *Agricultural News* for November 3, 1917 (Vol. XVI, No. 405). These measures prohibit the importation of any part of the sweet potato and morning glory plants into Florida from outside, and also prevent the shipping of any portion of these host plants from the infested areas in Florida, and the movement of any sweet potato tubers from the infested areas, unless first fumigated by an agent of the Plant Board, and certified by him.

FUMIGATION. Experiments made by Conradi have shown that all stages of this weevil can be killed by fumigating the tubers. Carbon bisulphide is used at the rate of 3 lb. to each 1,000 cubic feet of space, and it is essential that the compartment used for fumigation be air-tight.

REDUCTION OF DAMAGE. It is recognized that once the weevil has become well established in a district there is no satisfactory way of eliminating it, but much can be done to reduce the damage.

The following are some of the control measures which have proved to be of practical value in the Gulf States, and are also applicable to West Indian conditions. No one measure alone will have much effect in reducing the weevils, but a combination of all of them, if used thoroughly and systematically, will bring about a marked reduction in the numbers of the weevils and the extent of their damage. These methods can also be used with good results against the scarabee or Jacobs:—

1. Sweet potatoes should not be planted on the same land in two successive seasons, and the different sweet potato patches should be separated from each other as widely as possible. This makes it difficult for the insects to spread from one potato field to another.

2. When planting, be very careful to use only those plants which are known to have come from a locality where the weevil does not occur.

3. When harvesting the crop, great care should be taken to remove all portions of the sweet potato plants from the land. All vines, damaged tubers, pieces of root, etc., should be collected and burnt, otherwise they will only serve as breeding places for the weevil.

4. Infested or damaged sweet potatoes should not be thrown out, but should be burnt. If they are needed for feeding stock they should first be boiled. This will destroy any infesting grubs or weevils, and prevent the infestation of new areas.

If these measures are practised thoroughly it will be possible to reduce the damage done by the scarabee at a time when every available sweet potato is needed.

J.C.H.

MOSQUITOES AND MALARIA.

In the *Rhodesia Agricultural Journal*, October 1917, there is printed a lecture on malaria and black-water fever, by Dr. A. M. Fleming, C.M.G., M.B., C.M., Medical Director. Although the cause of malaria has been so absolutely proved by medical research in the last few years, there are still some people in the West Indies who do not believe that to mosquitoes, and mosquitoes alone, the infection of malaria is due. The lecture in question so clearly states the present knowledge on the subject, and the means to be taken for the prevention of malaria, that it is worth reproducing largely.

Malaria as a disease has been known and described from time immemorial. Long ago it was recognized that it was associated with residence in or near low-lying, marshy ground, and it was for centuries ascribed to some poisonous miasma or exhalation arising from such swampy ground as the result of decomposing vegetable matter. The breathing in of these mists or miasmas was supposed to infect human beings with malaria. In 1880, however, a French scientist discovered that in the blood of persons suffering from malaria there were invariably to be found minute organisms in the corpuscles of the blood. These organisms gradually grew in size, and subdivided into numerous little particles or spores. The corpuscles burst, and these spores were poured out into the blood streams, and found their way into other corpuscles where they went through the same process. Further he showed that the various stages of ague, high temperature, and excessive sweats, were coincident with the growth and the breaking up of these organisms in each successive cycle. Still it remained to find out how these organisms got into the blood. Thirteen or fourteen years later, Sir Patrick Manson suggested that in the case of malaria the organisms might be carried by some variety of mosquito. Major Ronald Ross, working in India, took this up, and was able to prove in a short time that the mosquito theory was correct, that the malaria parasite was taken up by the kind of mosquito known as anopheles, and that in the mosquito's body it went through various changes, and when mature was injected into healthy persons along with the saliva of the mosquito.

To prove this, numerous experiments were carried out. For instance, Doctors Sambon and Low spent three of the most unhealthy months of the year in a spot in Italy so infected with malaria that no one living under ordinary conditions ever escapes the disease. They lived in mosquito-proof houses, and were careful never to be bitten by a mosquito, the result being that neither of them was infected, although the inhabitants around were scourged with the fever. Again, some mosquitoes were allowed to feed on the blood of a person suffering from malaria in Italy. These mosquitoes were then brought to England and allowed to feed on two healthy persons who had never been in a malarial country in their lives, the result being that both had an attack of malaria. The success of the anti-malarial crusade in the Panama Zone, undertaken by the Americans under the direction of Colonel Gorgas, has proved abundantly what can be attained by systematic effort to prevent malaria. A region which for centuries was considered one of the most pestilential spots in the world is now a country where white men, women, and children can live and enjoy health.

So much for the cause of malaria. But how is malaria to be avoided? Four methods have been laid down:—

(1) By the extermination of malarial parasites by quinine.

(2) By the extermination of mosquitoes.

(3) By the protection of healthy persons from the bites of mosquitoes.

(4) By the isolation of malarial patients, so as to prevent them from affecting mosquitoes.

Theoretically, the strict observance of any one of these methods should be sufficient to prevent infection, but in practice it is impossible to ensure absolute observance in every case. What therefore is to be aimed at is a combination of these methods. In other words, as far as possible, destroy the parasite in the system, and keep down mosquitoes in and around houses.

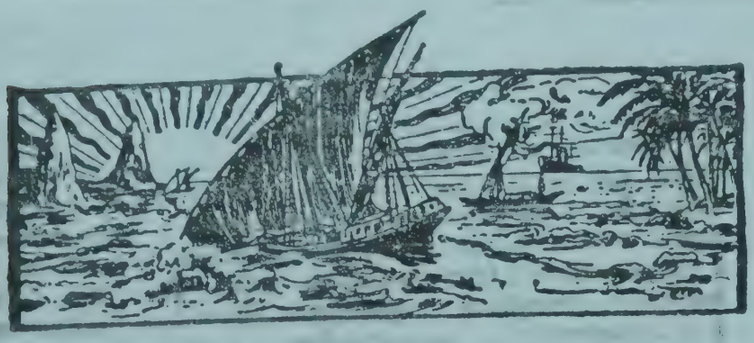
Firstly, quinine is the one drug which has proved itself to be a direct poison to the parasite. It is, however, difficult to take, with any degree of regularity, sufficiently large doses of quinine altogether to prevent an attack of malaria in cases of severe infection. As a preventive in malarial districts, the best method is to take 5 grains nightly, 10 grains on Saturday nights, and 10 grains on Sunday nights; and for a child, from $\frac{1}{2}$ to 3 grains nightly, according to age.

Secondly, there is the extermination of the mosquito. Depressions of soil where water might collect, should be drained, tanks should be mosquito-proof, and all rubbish like tins and bottles should be cleared up.

Thirdly, protection of individuals from mosquitoes. There are two methods for this purpose—the use of mosquito nets, and the building of mosquito-proof houses. The chief disadvantage of nets is that they are used only at night time, but the unfailing use of mosquito nets will do much to reduce the possibility of infection. Probably, however, the best method of protection is to have the house itself rendered mosquito-proof by affixing wire-gauze screens to all doors and windows.

Fourthly, the segregation and isolation of infected persons. This is not only a practical step, but fortunately also a simple one. Persons infected with malaria, or those likely to harbour infection should always sleep under a mosquito net, and should endeavour to avoid being bitten, as far as possible.

These four methods for the prevention of malaria are not in themselves either difficult to follow, or costly to practice, and yet how few living in malarial districts pay the attention to them that they deserve.



GLEANINGS.

Mr. W. N. Sands, Agricultural Superintendent, St. Vincent, reports that he has grown two strong plants of Bougainvillaea hybrids from seed sent by Dr. Perez of Teneriffe to the Imperial Commissioner of Agriculture. At present the leaves of these plants are more like those of *Bougainvillaea glabra* than *B. laterita*.

According to the returns received in the Department of the Director of Statistics with the Government of India, the number of sugar factories working in India in 1916 was twenty-eight. The annual output of these factories it is difficult to know. Roughly it must be about 100,000 tons. (The *Agricultural Journal of India*, October 1917.)

Among various exotic trees introduced into Uganda, the breadfruit tree is now thoroughly established, and frequently bears fruit. The fine collection of mangoes introduced from India in 1908 has also made excellent growth. (*Annual Report Botanic Department*, Uganda Protectorate, 1917.)

The sugar crop of Queensland for the season now ending is estimated as 346,000 tons, which it is hoped will be produced from a total amount of canes reaped, estimated at 2,900,000 tons. This will be the largest sugar crop ever produced in Queensland, and it is expected that it will realize the value of £7,266,000. (The *Australian Sugar Journal*, November 8, 1917.)

Apropos of the interest in tanning now being shown in these islands, the following from the *Kew Bulletin*, Nos. 7 and 8, 1917, may be of interest. The best mangrove bark or extract is not so acceptable to tanners as oak bark, valonia, quebracho, mimosa bark, etc.; the principal objection is its deep red colour, and it is only considered satisfactory for tanning leather when used in combination with better class substances.

In an account of a visit to the Rothamsted Experiment Station, a correspondent of the *Wealth of India*, October 1917, is struck with the magnitude of the work done there. Some idea of the work done on soil at Rothamsted in the course of twelve months may be formed, when it is explained that the farm is divided into more than 200 experimental plots, and that each year something like 250 samples have to be taken with proper precaution, and preserved for future reference

The piassava fibres of commerce are obtained from the sheathing cases of several species of palms. The palms from which they are obtained are all growing wild in their respective localities, and apparently are not under cultivation for fibre production. Some of these have been introduced into the West Indies as ornamental plants, notably the kitool palm (*Caryota urens*). (*Kew Bulletin*, Nos. 7 and 8, 1917.)

British Malaya is now the leading country for the production of cultivated rubber, and the industry has added very substantially to the prosperity of the Malay Peninsula during the past decade. The tendency has been spreading to devote more and more land to rubber planting. Alive to the danger of relying too much upon one industry, however successful, the authorities in Malaya are seeking to encourage development in other directions, and their policy has been warmly approved by resident planters.

From the report of the Government Cinchona Plantations and Factory in Bengal for the year 1916-17, we learn that the acreage under cinchona has been increased to 2,405 acres. For an outlay of 4,484,100 rupees the Government has received 5,124,900 rupees, and has acquired, within the period 1905-17, additions to factory buildings, etc., a large reserve of quinine, 2,738 acres afforested with timber and fuel trees, the 2,405 acres of cinchona, and a large output of other manufactured products, making a total return in cash and readily realizable assets of 11,766,634 rupees. (*Nature*, December 6, 1917.)

A recent calculation of the yield of sugar in Hawaii during five-year periods shows the following remarkable development in productiveness: 1902-6 the yield was 4·40 tons sugar per acre; 1907-11 the yield was 4·87 tons; and from 1912-16 the average reached was no less than 5·23 tons. It is claimed that the aggregate production, which increased from 1½ million tons for the first named period to upwards of 3 million tons for the period ended 1916, has been due to better agriculture rather than to increased areas. (The *Australian Sugar Journal*, November 8, 1917.)

Inquiries are often made as to the best way of getting rid of poultry ticks. The *Journal of Agriculture of Victoria* for November 1917, gives the following recommendation: A good remedy for poultry lice or ticks is kerosene emulsion, and it is easily made as follows: dissolve 1 lb. of common soap in 1 gallon of hot water, add 2 gallons of kerosene, emulsify with garden syringe, heat up mixture, and add 10 parts of water to 1 of the mixture. Use with a spray pump or syringe. Whitewash, as recommended by many poultry writers, is not as effective as spraying fowl houses with this mixture.

We are informed that there are two positions as Assistant Pathologists at present open in the Insular Experiment Station, Porto Rico. The salaries are, respectively, $1,800 and $1,500 per annum. One of these assistants will devote his time to sugar-cane investigations, and the other to questions connected with citrus cultivation. Applicants must have had a thorough training in botany and plant pathology. A Bachelor's degree or its equivalent will be required. Applications, with a statement of training and experience, may be made to Mr. John N. Stevenson, Chief of the Division of Botany and Plant Pathology, Insular Experiment Station, Rio Piedras, Porto Rico.

AGRICULTURAL EXAMINATIONS.

PRELIMINARY EXAMINATIONS.

Six candidates presented themselves for this examination in November 1917; four in St. Vincent, one in Antigua, and one in Barbados. Of these the one in Antigua failed to satisfy the examiners. Of the others, one of those from St. Vincent and the one from Barbados sent in such papers as entitled them to be placed in the first class. Of the other three in St. Vincent, one obtained a second class and the other two third class certificates. The two candidates who obtained first class certificates were found by the examiners to be well grounded in the majority of the subjects of the syllabus. One thing however, must be noted, the apparent want of knowledge displayed by the St. Vincent candidates of the value in agricultural operations of farmyard manure. This possibly reflects local agricultural practice in some degree.

INTERMEDIATE EXAMINATIONS.

For this examination five candidates presented themselves, one in St. Vincent and four in Antigua. From some unexplained circumstance, the report of the local examiners on the result of the oral examination of the candidate in St. Vincent has not been received by the Imperial Commissioner of Agriculture. Of the four candidates in Antigua one failed to satisfy the examiners, the other three obtained third class certificates. These have gained their practical experience in agricultural matters only in work connected with the Botanic and Experiment Stations in that island. The local examiners report that the candidates, as a whole, exhibited some weakness in their knowledge of estate practice. One of them, however, showed good acquaintance with the practical cultivation both of cane and cotton, the special subjects selected by him for examination. The written papers were fairly well answered, with, however, a tendency in many cases to vagueness of expression and slipshod grammar.

RESULTS.

PRELIMINARY EXAMINATION.

Name.	Island.	Result.
E. O. C. Walker	St. Vincent	1st class
H. F. Wall	,, ,,	2nd class
C. A. Marshall	,, ,,	3rd class
S. F. Leigertwood	,, ,,	3rd class
K. R. C. Foster	Barbados	1st class

LIST OF EXAMINERS.

The Imperial Department of Agriculture is indebted to the following agricultural officers and planters for the care and trouble exercised in the conduct of these examinations:—

A. E. Collens, Esq., F.C.S., Acting Superintendent of Agriculture for the Leeward Islands.
T. Jackson, Esq., Curator, Botanic Station, Antigua.
R. S. D. Goodwin, Esq., Collins Estate, Antigua.
John Roden, Esq., Diamond Estate, Antigua.
W. N. Sands, Esq., F.L.S., Agricultural Superintendent, St. Vincent.
S. C. Harland, Esq., B.Sc., Assistant for Cotton Research, Imperial Department of Agriculture.

The examination papers were prepared as usual at the Office of the Imperial Department in Barbados, and the local reports and the corrected papers examined by Sir Francis Watts, K.C.M.G., the Imperial Commissioner of Agriculture, and the Rev. C. H. Branch, B.A., Acting Scientific Assistant.

Below will be found the questions set for the Preliminary paper. The questions set for the Intermediate examination will be published in the next issue of the *Agricultural News*.

PRELIMINARY EXAMINATION.

The preliminary examination of the Imperial Department of Agriculture was held in St. Vincent, Barbados and Antigua during November 1917.

Of the thirteen questions set not more than nine were to be attempted, which had to include three from Section A, three from Section B, and one from Section C. The remaining two questions were allowed to be selected irrespective of the section.

The following are the questions set for the written paper:—

A. THE SOIL.

1. Give the chief reasons for cultivating and tilling the soil. What are the objects for which (a) ploughing, and (b) harrowing are respectively employed?

2. What methods are employed in practice to increase the amount of nitrogen in the soil?

3. What is the effect of a large proportion (a) of clay, (b) of sand in a soil? How may heavy soils be made lighter?

4. Explain the reasons why the application of lime to soils is beneficial.

B. THE PLANT.

5. What gas do green plants give off under sunlight? How can it be shown in a simple way that they do give off this gas?

6. Describe by means of labelled drawings *only*, the structure of any two of the following: (a) a cane stem, (b) a lime fruit, (c) a cotton pod, (d) a cacao pod, (e) a banana fruit, (f) a green leaf, (g) any common flower.

7. What are the reasons why a sufficient supply of water is necessary to plants? Describe how plants take in water.

8. Describe in detail some piece of work you have done in sowing seeds, giving reasons for the various operations.

C. THE ANIMAL.

9. Describe the structure and action of the heart of any mammal.

10. State the functions of the blood in such a mammal.

11. Give a general account of the digestive process of a horse.

12. Relate any observations you have made as to damage done to crops by birds or vermin.

13. Describe how a horse's age may be known by the appearance of its teeth.

The New Ford Tractor.—The Ford tractor which has recently been tested with good results by the Royal Agricultural Society of England, and thousands of which have been ordered for use, has the following chief points:—

The tractor has no real chassis; the radiator is fixed directly to the motor which is supported by arms attached to the axle. The wheels are of steel, and all the working parts are completely closed in to protect them from dust and mud. The tractor weighs less than a ton. The motor is a large size of that used for the Ford automobile, giving 20 b.h.p. with a 10 h.p. pull at the draw bar. There are three speeds and a reverse.

PLANT DISEASES.

FOMES LUCIDUS AS A PARASITE OF TREES.

The fungus above named has come to notice from time to time in these islands as a suspected parasite working on the roots and collars of various trees. Its occurrence on the roots of lime trees in Montserrat was discussed in the *West Indian Bulletin* by Mr. F. W. South (Vol. XII, p. 493) who found the evidence strongly suggestive that it was responsible for some of the losses of trees experienced in that island and in Antigua.

A case in which, owing to the absence of complications, the connexion of this fungus with root disease was more clearly indicated received some attention from the writer in St. Kitts in 1914. At the Basseterre Botanic Gardens a row of large Saman trees (*Pithecolobium Saman*) was thinned out a few years ago by cutting down alternate trees. About a year afterwards three of the remaining trees died with a fungus rot of the roots, and an adjacent hedge of bread-and-cheese (*P. unguis-cati*) was similarly killed. The Saman trees have continued to die one by one. White mycelium is plentifully developed, in some places in thick masses, under the bark of the collar and roots, and large sporophores of *Fomes lucidus* regularly grow out from this when the tree is dying or dead. The bracket-like fructifications attain in well-grown examples to a diameter of 30 centimetres. They are usually supported on short thick reddish-black polished stalks single or fused; the upper surface is irregularly wrinkled and has the appearance of being coated with brownish-red lacquer; while the under side when fresh is whitish or buff in colour. The fungus has been similarly associated with root disease of coco-nut, mango, and Poinciana in Ceylon.

A letter recently received from Mr. P. J. van Breemen, Director of the Agricultural Department at Curaçoa, gives the information that the fungus has come under suspicion there of being the cause of a white rot of *Caesalpinia coriaria* and *Acacia tortuosa* which is at present under investigation.

Coincident with this re-opening of the subject there has come to hand a reprint from the *South African Journal of Science* containing a note by the Union Mycologist, Mr. P. A. van der Bijl, on the occurrence of the same fungus on certain trees, particularly *Acacia* spp. and willow in South Africa. The death of a large number of acacia trees around Pretoria is attributed to the fungus, and the fact that *Acacia mollissima*, the cultivated wattle, is involved, adds to the economic importance of the disease. The author regards the fungus as a facultative parasite, which is only likely to become established when the ability of the trees to resist its attack is impaired by unfavourable conditions. This agrees with the conclusion formed by the present writer with regard to lime trees in Montserrat and elsewhere in these islands.

The action of the fungus on the wood of the willow is described as one of delignification and digestion which proceeds slowly and gradually.

The importance of methods of control aiming at the destruction of the fructifications and of all material harbouring the mycelium of the fungus is emphasized, on the ground that the mycelium remains active and retains its power of fruiting for years after the host plant is dead.

The note contains a useful discussion of the synonymy of the fungus. The author uses the name *Polyporus lucidus*, and points out that a generalized description covering the rather wide range of variability shown by the fungus will also include a number of forms which have been described as distinct species.

Saccardo gives the name of the fungus as *Fomes lucidus*, a rendering which has been followed in the publications of this Department. The usually accepted distinction between Polyporus and Fomes, namely the annual character of the former and the perennial habit of the latter, is one which in practice may be very difficult to apply, especially in the tropics. If Murrell's scheme of classification be accepted, the fungus should presumably be placed in the genus Ganoderma. The absence of all synonymy, combined with the general use of new and unfamiliar names, in the last mentioned writer's monograph on tropical Polypores, hinders one from learning his views on the fungus in question.

W.N.

HOME-GROUND CORN MEAL.

A correspondent of the *Journal of the Jamaica Agricultural Society*, December 1917, contributes the following useful hints, which may be of practical value as a suggestion to housekeepers in other islands:—

'I have made corn meal with my coffee mill that would make some of the imported corn mills feel ashamed. This is how I do the thing: First, I have the mill properly cleaned with hot water and dried. Then I screw it down so that the corn comes out in coarse grit from the first grinding. Secondly, I screw it up to three-quarter tight, and pass the grit through which should come out nearly done. Thirdly I screw up as tightly as possible, return meal to mill and the result is that after sifting I get as fine a meal as could be desired. Again, if I desire to have a real good plate of pea soup, all I have to do is to pass the peas through the mill before cooking, and the result is marvellous. I have not tried it with banana or potato chips, but I feel confident that the same results can be obtained. Of course, it takes up more time and labour than the corn mill, but the results pay when you haven't got a corn mill of your own or one near by.'

A kitchen corn mill used to be very common in Barbados thirty or forty years ago, in which the daily supply of meal for the household was ground from fresh corn. A return to the old practice is certainly advisable now.

THE CANARY PINE.

The question of afforestation, or reafforestation, is one of some importance in many of the smaller West Indian islands. The kind of tree which it is best to plant on nearly denuded areas is worthy of consideration, and any hints as to valuable forest trees possibly suited to West Indian conditions, especially to those in the drier islands, are valuable.

Dr. G. V. Perez of Teneriffe, in an article contributed to the *Bulletin de la Société Nationale d'Acclimatation de France*, August 1917, draws attention to the merits of a species of pine tree (*Pinus canariensis*) indigenous to the Canary Islands, for afforestation purposes. He says that this pine has been found to grow well in all of the warmer temperate countries bordering on the Mediterranean, and also has been introduced successfully into South Africa, Chile, Australia, and New Zealand. The tree grows vigorously from coast lands to a height of 1,500 feet above sea level. In discussing the merits of the tree, Dr. Perez states that its wood is one of the hardest, unsurpassed for endurance

and resistance to every variation of temperature: even when buried in the earth it lasts like iron. The tree is of fairly rapid growth after the first eight or ten years: thus at twenty years of age the height of one of these trees may reach 20 to 30 metres with a diameter varying from 20 to 30 centimetres. Its adaptability to various conditions is great. It endures a large amount of moisture or very dry conditions. Strong winds do not cause it to fall, as is the case with other species of the genus, and it can withstand some degrees of frost. When cut down it springs again from the trunk, which is a rare habit among pines. These trees may be planted at a very short distance from one another, 1·25 metre apart, and even 1 metre apart in very dry soils, is the advice given as the result of his experience by M. F. Albert, the Chief of the Forest Department in Chile. Another admirable feature of this tree is that its trunk grows perfectly straight, even when the tree is isolated. Dr. Perez considers that *Pinus canariensis* is an ideal forest tree for warm temperate regions, especially with regard to its tolerance of drought.

It might be advantageous if experiments were made in these drier tropical islands as to the adaptability of this tree to local conditions.

HOG CHOLERA IN BARBADOS.

In a letter to the *Barbados Advocate*, February 5, Dr. R. A. Stoute, D.V.S., Government Veterinary Surgeon, states that after making several post mortems, as well as doing other work, Dr. Johnson, the Government Bacteriologist, and he have been able to pronounce the disease among hogs which exists at present in the island to be hog cholera or swine fever. Unfortunately they have been unable to trace its origin.

After quoting in full the symptoms of the disease from Dr. Dorset's book on hog cholera, Dr. Stoute gives some suggestions which he hopes may be helpful. They are as follows:—

'On finding that your hogs are affected with hog cholera give to each well animal a dose of salts in its drinking water. Some American farmers recommend one large tablespoonful of charcoal in each animal's feed twice a day as a preventive.

'I would suggest, when practicable, to remove the well hogs from the sick ones, and consequently from the infected pens. Thoroughly wash each hog with soap and water, putting a little Jeyes fluid in the water; be careful to wash the feet and lower parts of the abdomen; be careful that no manure is carried from sick pens to new ones, and keep each hog as much separated from others as possible. Under no consideration allow attendants to visit the pens with the sick hogs, and then go to pens with healthy animals. The utensils used for feeding before removal must not be used with the hogs after being separated.

'One of the rules issued by the Board of Agriculture and Fisheries in England is that every person going in or to a sty with a hog sick of swine fever must thoroughly wash his hands with soap and water, and must also wipe his boots or feet.

'The spread of the disease here cannot be accounted for, but, as birds are blamed for carrying the infection on their feet, I am inclined to blame our blackbird for at least helping to spread the infection.

'Under no consideration allow a fresh animal to be brought into the herd, or allow any animal to be sent from an infected herd, except under certain regulations which I presume will have to be carried out by the Sanitary Authorities.

'In addition to the above it must be remembered that the pens, troughs, and all utensils used with the hogs must be kept perfectly clean, and the bedding must be also kept as clean as possible.'

Dr. Stoute has supplied some of the local druggists with a prescription which Dr. Dorset is of opinion acts principally as a tonic, and so improves the health of animals.

This deadly disease was the subject of an article in the *Agricultural News*, December 1, 1917, p. 378, to which our readers are referred. This was based on *Farmers' Bulletin No. 834*, of the United States Department of Agriculture, August 1917. We quote the following from the bulletin referred to: 'no drug or combination of drugs is known which can be regarded either as a preventive or a cure in the true sense of the word for hog cholera. Only one agent known can be regarded as a reliable preventive, that is anti-hog cholera serum. . . . Complete immunity from the disease is obtained by the injection of hog cholera virus in addition to the serum. The practice is to administer the germs of the hog cholera in the virus, and at the same time to give a dose of serum, which will protect the hogs from cholera. The theory is similar to that of vaccination.' In view of the magnitude of the interests involved it would seem to be desirable that such serum be obtained, as it may be, from the licensed manufacturers thereof in the United States.

ECONOMY IN FOOD CONSUMPTION.

An article in *The Field* of November 24, 1917, very truly remarks that 'the solution of the food problem will be found in careful harbouring of supplies rather than in increased production. It will be the duty of all, in a position to do so, to exert themselves in augmenting the output of essential commodities. The farmer as the principal producer has a heavy responsibility in the matter, but the smaller holder and the allotment holder will be required to play a proportionate part, if it be only to grow enough for home use. The work of production must be encouraged in every way compatible with the public interest, for there is a limit that we need not be afraid of exceeding, from home sources, below which supplies cannot be reduced without imperilling the nation; but, while it may be assumed that the minimum standard of output can be maintained, it would be unwise to count upon any considerable quantity in excess of it. If the critical period is to be surmounted, it will certainly be necessary to insist upon strict economy in the homes of the people. Indeed, in the opinion of many careful economists the consumer can go at least as far as the producer towards solving the vital problem that now confronts the nation. While the one can help through increased exertion on the land, the other has an equally effective part to fill in economising in the home. There must be an advance from both directions towards the point at which safety is to be found. Since this sharing of responsibility has been insisted upon in these columns before, as the only means of overcoming the food difficulties, we note with peculiar satisfaction the prominence that is now being given to economy in consumption. It may well be said of the economy movement that this way lies the safety of the country. The farmer can do much, and, subject to the weather will strain the resources of his holding to the utmost, but if the consumer fails to do his part, which is not so susceptible to natural disturbances, the trial will not be successfully surmounted.'

MARKET REPORTS.

London.—The West India Committee Circular, December 27.

Arrowroot—No quotations.
Balata—Venezuelan Block, 3/3¾; Sheet, 4/- to 4/1.
Beeswax—No quotations.
Cacao—Trinidad, 94/- to 99/-; Grenada, 85/- to 96/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quatations.
Honey—Jamaica, 134/- to 144/- per cwt.
Lime Juice—Raw, 2/- to 3/.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—4½*d*.
Rubber—Para, fine hard, 2/9½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., January 15

Cacao—Venezuelan, $12·00 to $12·25 Trinidad, no quotations.
Coco-nut Oil—$1·35 per gallon.
Coffee—Venezuelan, 12c. per lb.
Copra—$7·70 per 100 lb.
Dhal—No quotations.
Onions—$8·00 per 100 lb.
Peas, Split—$12·00 to $12·50 per bag.
Potatoes—English, $4·50 to $5·00 per 100 lb.
Rice—Yellow, $11·50 to $11·75; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros. & Co., January 1

Cacao—Caracas, 12¾c.; Grenada, no quotations; Trinidad 13½c. to 13¾c.; Jamaica, 9c. to 10¼c.
Coco-nuts—Jamaica selects, $38·00 to $40·00; Trinidad selects, $36·00 to $38·00; culls, $18·00 to $20·00 per M
Coffee—Jamaica, 9¼c. to 11c. per lb.
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Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
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Rice—Ballam, no quotations; Patna, no quotations; Rar good, no quotations.
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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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The American Way.

THE following, from an address given by the Secretary of Agriculture of the United States of America, Mr. Houston, to the Association of American Agricultural Colleges and Experimental Stations, is so apposite to present conditions, that no apology is needed for reproducing it from *Science*, November 30, 1917:—

'According to the calendar it is almost a year to the day since my last meeting with you. Judging by the experiences through which we have passed, it seems more like a generation. Then this country was at peace, though its patience was being sorely tried. Now it is at war for reasons which I need not discuss before this body. It had no alternative. It either had to fight or to admit that it had no honour, was not a free nation, and would henceforth be subjected to a mediæval power that in the last analysis knows no law but might. The nation was living on a peace basis, and was not fully prepared for war in any respect; but it was fortunately circumstanced in the character of its agricultural organization, and the number and efficiency of its expert agencies.

'The nation may well pride itself on the fact that it had had the foresight generations ago to lay deep its agricultural foundations. I congratulate the representatives of the land grant colleges on the fine opportunity for service presented to them, and on the splendid way in which they have seized it. The Department of Agriculture had had great comfort in the thought that these institutions, ably planned and wisely directed, existed in every part of the nation, and stood ready not only to place themselves at the service of the national government, but also to take the initiative in a vast number of directions.

'When a state of war was declared on April 6, the food situation was unsatisfactory. The need of action was urgent, and the appeal for direction was insistent. The nation looked for guidance primarily to the Federal Department, and to the State agencies which it had so liberally supported for many generations. It was not disappointed.

'In a two-day session at St. Louis the trained agricultural officers of the country conceived and devised a programme of legislation, organization, and practice, the essential features of which have not been successfully questioned, and the substantial part of which has been enacted into law, and set in operation. This great democracy revealed its inherent strength.

'To the normal forces of the government dealing with agriculture and rural problems there has been added an emergency agency with great and unusual powers, with enormous possibilities for good, and with a remarkable record for achievements already to its credit. It has enlisted in its ranks men of wide experience, fine spirit, and high ideals, many of whom are gladly volunteering their services for the common cause. I refer to the Food Administration under the direction of Mr. Hoover.

'The relation between this agency and the other organized agricultural forces of the nation is intimate and fundamental. It is impossible completely to disassociate them, and it would be undesirable to do so.

'The problem in part is a common one, and it is of the first importance that the work be done in the closest co-operation, and with an eye single for the public good. There is no need for undue duplication of effort, and no causes of friction which cannot be removed through an intelligent conception by each agency of the powers and purposes of all, and by a spirit of mutual accommodation. In a broad way it is agreed that the prime function of the Department of Agriculture shall be the stimulation of production, the conservation of products on the farm through all the normal and approved processes, the promotion of better marketing and distribution of products from the farms to the markets, the prosecution of the work in home economics along usual lines, the dissemination of information, and the extension of all these activities as authorized by law. In a similar way the principal function of the Food Administration is the control and regulation of commercial distribution of foods; that is of products which have reached the markets, are in the channels of distribution or in the hands of consumers, their conservation by consumers, the elimination of waste, and the handling of foods and feeds in the market by legal means, through its regular officials as well as through its volunteer agencies.

'In the main the Department of Agriculture deals with all the processes of farming up to the time products reach the market, until they are in the requisite form for consumption, and are available for the purpose. At this point the Food Administration enters and exercises its wide powers of regulation, direction, and suggestion. Where the Food Administration through its powers can be of assistance to the Department of Agriculture in its field, it is at liberty freely to make suggestion, and when necessary, to co-operate in execution; and the same relation obtains as to the department's participation in food administration matters in which it has a vital interest, and toward the promotion of which it can be of assistance. This is the substance of the agreement originally entered into between the Food Administration and the Department of Agriculture, and will be more satisfactorily observed as the agents and divisions of the two departments familiarize themselves more fully with their tasks and with the prescribed lines of efforts.

'Obviously the making of a programme for the agricultural actitives of the nation did not end with the St. Louis conference. Thought, action, and co-operation between the members of this association and other state agencies on the one hand, and the federal department on the other, have been continuous. Attention has been given without cessation to problems in the field of labour. It was obvious that difficulties would be presented, and that apprehension would run beyond the actual condition. An army could not be raised without taking men from every field of activity and it would have been unfair to any class of workers in the community to have proposed its exemption It was impossible, in the haste of the first draft, satisfactorily to work out in detail the principle of selective service; but, nevertheless, under the regulations, consideration was given throughout by exemption boards and by the officers of the War Department to the needs of agriculture. With ampler time at its disposal, the War Department has worked out a system of classification which gives due regard to the necessity of retaining skilled farmers and expert agricultural leaders on the farms and ranches, and in the educational and administrative services.'

THE FOOD OF THE WEST INDIES.

The Hon. H. A. Alford Nicholls, C.M.G., M.D., F.L.S., Senior Medical Officer of Dominica, has contributed to this Journal the following article on the above subject which is claiming so much attention at present in these islands:—

Some time ago in one of the West Indian colonies the question of the deficiency of protein in the food of the people became the subject of official reports, and it was asserted that this deficiency involved a starving and stunting of young growing persons, and a lowering of the physique of the people, with the consequent diminution of their working power.

It was also considered that the low protein content and the excess of carbohydrates in the food were the causes of the prevalence of pellagra and peripheral neuritis.

The official papers in regard to the questions raised were sent to me for my consideration and report. The matters dealt with are of interest to the West Indies generally, and a request was made to me that my report should be published

With the sanction of the Government it now appears as this paper, suitable for the general reader. All special official references have been eliminated.

It may be taken as an incontrovertible fact that the greater part of the food of the people of the West Indies generally is made up of vegetable products which contain much carbohydrate and relatively little protein and fat.

A healthy working man requires a supply of food capable of creating potential energy equal to from 3,000 to 3,500 calories daily; and, as regards the nature of the food, one authority gives the following table of what might be considered a satisfactory allowance:—

Protein	125 grams	equal to 512·5	calories
Fat	105 ,,	,, 976·5	,,
Carbohydrate	420 ,,	,, 1,722·0	,,
		3,211·0	calories

Other authorities, whilst agreeing as to the quantity of protein, diminish the fat somewhat and increase the carbohydrate; but there is a consensus of opinion as to the necessity of the potential energy reaching 3,000 calories or over.

These views concerning quantities have within recent years been called in question. Thus Chittenden (*Physiological Economy of Nutrition*, New York, 1904) shows that health and efficiency are compatible with a diet containing much less than the accepted minimum of protein. His conclusion was that 'the amount of proteid food needed daily for the actual physiological want of the body is not more than one half that ordinarily consumed.' Since the publication of the result of Chittenden's work it has been demonstrated in Germany that he was right, and that 75 grams of protein daily is a sufficient quantity for an average man.

Of course, if too little proteid food be taken, the muscular tissues are not properly nourished, and there is less resistance, to disease. And undoubtedly this occurs in regard to some of the people of the West Indies who live almost entirely on so-called ground provisions. But, in most instances this food is supplemented by fresh and salt fish, and by peas and beans—in which the protein content is high—and occasionally by other foods rich in nitrogenous matters.

One of the principal leguminous foods of the people is the pigeon pea (*Cajanus indicus*) which is grown extensively throughout the West Indies. It is richer in protein than salt fish, and much richer than bread made of the white wheaten flour imported into the West Indies. The following table shows the composition of pigeon peas and white bread:—

	Pigeon peas.	White bread.
Water	10·5	39·0
Protein	22·3	6·5
Fat	2·1	1·0
Carbohydrate	60·9	51·5
Fibre	1·2	
Mineral matter	3·0	1·0

That the majority of the labouring people get enough protein in their food would appear to be evident from the fact that they are not short-lived, and that they are capable of performing continuous heavy work. Those of them, however, who are mainly vegetarians by necessity are compelled to consume large quantities of food in order to supply the need for protein. The result is that the digestive apparatus is often distended by the excess of the carbohydrate portion of the diet which cannot possibly be digested, and which consequently is responsible for gastro-intestinal complaints.

In connexion with the food of the West Indies it should be remembered that the bulk of the people have lived on it for generations, that they have increased and multiplied on it, and that they are 'the hewers of wood and the drawers of water.' Human beings become adapted to conditions under which they live. The negro of the tropics manages to live and work and increase in numbers mainly on vegetable food, whilst the Esquimo of the arctic regions thrives on meat and blubber. In both of these instances there is a contradiction of the dictum that a diet necessary to maintain health must be made up of definite proportions of protein, carbohydrate and fat.

In order that human beings may be kept healthy and well-nourished, it was considered that their food should contain due proportions of (1) protein, (2) carbohydrate, (3) fat, and (4) water. Comparatively recent acquisitions of knowledge, however, show that to these four essential elements there must be added a fifth, to which, in 1913, Funk gave the now accepted name of vitamine. Later discoveries have shown that there are two kinds of vitamines, viz., (a) the anti-neuritic vitamine which exists in the seeds of cereals and pulses, and in fresh meat and eggs of animals; and (b) the anti-scorbutic vitamine which occurs in abundance in fresh fruits and vegetables, and sparingly in meat and milk.

Vitamines have not yet been isolated, so that their composition is not known, but their necessary presence in food has been demonstrated beyond doubt by biological experiments. Their absence in diet results in what are known as deficiency diseases, such as beri-beri (which is a specific multiple neuritis) pellagra, and scurvy.

As the people of the West Indies obtain an abundance of fresh vegetables and fruit containing anti-scorbutic vitamines, scurvy does not occur amongst them.

Pellagra and peripheral neuritis are degenerative diseases of the nervous system, due to defective metabolism resulting from the deficiency in diet, not of protein, but of anti-neuritic vitamines. The food of the people of the colony referred to, whilst rich in carbohydrate, appears, according to general accepted ideas, to be deficient in protein, so it was suggested that the labourers of the island would be better off if they lived largely on imported wheaten flour, and devoted all their energies—which it was believed would be thereby increased—to the cultivation of articles for export.

Wheaten flour, imported from Canada and the United States, is consumed in large quantities throughout the West Indies. It is a white flour consisting of the endosperm of the wheat, the embryo and the aleurone layer—in which the anti-neuritic vitamines occur—being separated in the roller milling, and carried away in the bran. White wheaten flour, therefore is useless in preventing deficiency diseases, indeed it has been found that it will give rise to multiple neuritis, if used as a sole diet.

The protein content of bread made from wheaten flour is 6 5 per cent.; and larger amounts of protein can be supplied by the ingestion of peas and beans, which are grown abundantly throughout the West Indies. The people therefore should be taught to eat leguminous foods largely, and should be encouraged in every possible way, as has been very properly urged, to keep small live stock such as pigs fowls, etc., in order to supplement their main vegetable diet with animal food. If this plan were carried out, doubtless there would be in time an improvement in their physique, and a marked diminution of the prevalence of deficiency diseases.

(*To be continued.*)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. Mr. W. N. Sands reports general routine work in the Botanic Gardens during the month of January. The reaping of various crops was continued. The prospects are said to be not so good as last year. The planting of ground provision crops was extensively carried on. Corn and peas were also planted where conditions were favourable, the excellent rains enabling good progress to be made. The export of live stock, poultry, and eggs, as well as farine, yams, cotton seed, and cotton-seed oil has been prohibited except under license. The export of sugar, syrup, and molasses had been already prohibited on similar terms. The granary's bins containing 1,200 cwt. of kiln-dried corn were filled and sealed. It is hoped to keep this in reserve for some little time. The refining of cotton-seed oil for local consumption was continued at the ginnery. The Agricultural Superintendent visited Bequia in connexion with the destruction of silk-cotton and John Bull trees in a campaign started against the native food-plants of the cotton stainer in that island. The pest had done a great deal of damage during the past season. At several places visited by the Cotton Inspector old cotton stalks were being destroyed, and food crops planted. A similar condition of affairs is reported from the Land Settlement estates of Lindley Valley and Belair, where the people were said to be busily engaged in planting ground provision crops.

The rainfall recorded at the Botanic Station during the month was 7·86 inches, and at the Experiment Station, 6·43 inches. The rainfall for 1917, the Agricultural Superintendent remarks, was exceptionally well distributed in most districts of the Colony. There were no floods or continuous rains to cause damage to lands or crops as in 1916. The year's rainfall, recorded at the Botanic Gardens, was 102·35 inches, which was 5·17 inches below the average of the last twenty-four years. At the Experiment Station the precipitation was 88·75 inches. At coast stations and other districts it nowhere exceeded 70 inches. The monthly returns show that the month of July was wetter than usual, but that the rainfall of the other months closely approached the average, with the exception of November and December, which were very dry and much below it.

ST. LUCIA. From the report of the Agricultural Superintendent for the month of January it appears that work in the Experiment Station included reaping cassava and preparing farine and starch on a commercial scale; reaping sweet potatoes and making from them flour and chips for bread. Plant distribution was as follows: limes, 1,200; grafted mangoes, 26; budded oranges, 8; ornamental plants, 11. There were also distributed 400 tannia and 400 dasheen plants, 1,000 cassava cuttings, and 198 packets vegetable seeds. Further progress, Mr. Brooks states, has been made with the erection of a koker to prevent the sea-water from entering the Botanic Gardens at Castries. The concrete bridge referred to in the last report is almost completed. Special work has been undertaken, as indicated above, in making farine, starch, sweet potato flour, and dried potato chips. Corn meal and bread made from these flours and meals were supplied to members of the Food Committee and to several prominent families. Assistance was also rendered to the management of the leading bakery in Castries in making sweet potato bread and corn meal bread. The rainfall for the month, recorded at the Botanic Station, Castries, was 5·46 inches; at the Agricultural and Botanic Station, Choiseul, 3·08 inches.

DOMINICA. Mr. Joseph Jones, the Curator, reports plant distribution during the month of January as follows: limes, 1,500; budded citrus, 42; cacao, 150; shade tree cuttings, 100; eucalyptus, 100; bamboo, 100; miscellaneous, 116. In addition 128 packets of vegetable seeds were sold. Work in the Botanic Gardens was of a routine nature. The local price for fresh limes rose from 8*s.* to 10*s.* per barrel. The rate for ripe limes dropped from 7*s.* to 6*s.* 6*d.* per barrel. The lime crop for 1917 amounted to 396,184 barrels of fruit. This is an increase of 12,000 barrels over the crop of 1916, and 5,000 barrels in excess of the record crop of 1913. The love vine (*Cuscuta americana*), a parasite on lime trees, is reported to be spreading to new localities, and legislation on the lines of that adopted in Grenada and St. Lucia has been suggested by several planters. During the first half of the month the weather was very dry, only ·08 inch of rain being recorded from the 1st to the 15th. Towards the end of the month, however, the rainfall was considerable, the total for January being 6·02 inches.

MONTSERRAT. Reporting for the month of January, Mr. W. Robson states that the effects of the long drought since November have been very evident in the Experiment Station during the month. Work of a routine nature was nevertheless performed. Plant distribution included 500 bay plants, 400 sugar-cane cuttings, and 1 lb. of cowpeas. In the Botanic Gardens a distillation of growth of the American horsemint was made with moderately satisfactory results, as shown by analysis at the Government Laboratory. Five distillations of bay leaves were also made, one of which yielded at the rate of 21·7 oz. of oil per 100 lb. of green leaves.

The destruction of old cotton plants fixed by law at January 31 has been pushed forward, but several areas were granted exemption until February 23. It is now evident, says Mr. Robson, that the crop, if it does not exceed, will nearly reach 400,000 lb. of lint. By a recent opportunity 516 bales of cotton, together with lime products, were shipped during the month. A large proportion of the crop will not be delivered to the Government unless it is commandeered, and under the present arrangements the export of this cotton is prohibited. A very large area is ready for planting the new crop, and planting in March will be largely undertaken if rains permit. The planting of vegetables and corn during the last two months has been almost impossible, and a shortage of supplies is feared in a month or two. Two tins containing 74 lb. of bay oil distilled from the experiment plot were shipped to England, as well as samples of cotton lint for spinning tests. Investigation was made into the question of the suppression of lint length in second crop pickings of cotton, and the results obtained were forwarded to the Head Office at Barbados. The rainfall for the month, recorded at Grove Station, was 2·64 inches. The island has not been so dry in January in any previous year.

ANTIGUA. The Curator, Mr. T. Jackson, in items of departmental interest for the month of January includes the following plant distribution: onion plants, 132,050; cane plants, 50,000; coco-nuts, 412; miscellaneous, 30; yam sets, 520; vegetable and flower seeds, 10 packets; cotton seed, 26 lb. On account of exceptionally dry weather only routine work was performed in the Botanic Gardens. Rain fell in the central and southern parts of the island during the month, and the planters took advantage of this to put out their onion seedlings. In the western and northern districts very little rain fell, and all crops are suffering considerably. Where rain fell, corn and vegetable crops were put in. On

account of the recent drought, the crops of sweet potatoes have in certain parts been a failure. This, Mr. Jackson observes, is a serious matter at the present juncture, as there is a decided scarcity of foodstuffs in the island. During the month the engine at the granary was taken to pieces, the various parts receiving necessary attention, and the engine re-erected. The corn grinder was taken down and moved to a new position. This useful work was done by Mr. Henzell, and the thanks of the community are due to him for his valuable services. A preliminary run was made with the meal-maker, and several bags of corn meal were made. It would seem as though the alterations effected are such as to allow corn meal to be made in the future. This work is being proceeded with. More than 10,000 lb. of seed-cotton were purchased by the Antigua Cotton Growers' Association. Aproximately 30 acres of land have now been allotted to peasants in connexion with the Sawcolts Land Settlements Scheme. The rainfall during the month has been meagre, only 97 parts being recorded at the Botanic Station.

In the report of the Agricultural Instructor, which is appended to the foregoing, it is stated that the peasants have fully realized the seriousness of the food question, and are utilizing all available lands at their disposal, which are not at present under cotton, for the planting of provisions. Fresh areas are being opened up for this purpose. The planting of corn has also been started, but to a limited degree, the time being regarded by some peasants as out of season for this crop.

ST. KITTS. The Agricultural Superintendent, Mr. F. R. Shepherd, writes to say that owing to the very dry weather little could be done in the Botanic Gardens beyond watering to keep the plants alive, together with general routine work.

The Basseterre sugar factory commenced to grind at the end of the month with the prospect of a very small output, as the canes were short and stunted. The germination of the young cane crop is very poor, and, in addition to the lack of rain, the very high winds now prevailing make it difficult to establish a good stand of cane. On many estates it has been impossible to plant out the sugar-cane variety experiments for this season. The cotton crop is now off, and the land is being prepared for planting canes. There seems to be a great tendency to increase the acreage in cotton for the coming season, and to this end all the selected seed has been already engaged. The rainfall for the month was 1·06 inches, registered in very small quantities, the highest being ·17 inch.

NEVIS. Mr. W. I. Howell, Agricultural Instructor, writes to say that operations at the Experiment Station during the month of January have been practically at a standstill on account of dry weather. The cotton plot had been reaped, and a return of 1,700 lb. of seed-cotton obtained, which is a record for the plot. The old cotton plants are being pulled up. The corn crop is ripening, but the returns will be very poor, as the crop was badly affected by the drought. With regard to staple crops, Mr. Howell states that the cane crop is being reaped with very poor returns Sugar is being made on all the estates, and sold at good prices in the local market. Planting for next season's crop is not yet completed, and, on account of the dry weather, germination of plants is bad. The cotton crop has almost been reaped, and, as was expected, the returns from the late fields have been very poor. Cotton stainers are very prevalent throughout the island, and quite a large number of bolls were attacked by internal boll disease, causing a great amount of stained cotton. Preparation for next season's crop has begun in some places but there are still many fields of old cotton left standing. The reaping of potatoes is still in progress but the supply of provisions generally is getting less and less. The total number of bales of cotton purchased for the Imperial Government to the end of January was 166. The rainfall for the month was 2·18 inches.

AGRICULTURE IN BARBADOS.

January closed with a rainfall of about 2 inches in the south, south-western, and western parts of the island, while in the districts in the centre of the island he register was slightly over 4 inches.

A larger rainfall would have been very acceptable, but we cannot say that January was a very unfavourable month either for the young or for the old crop, although the prevailing high winds have caused the old crop to present a more weather-worn appearance than would otherwise have been the case.

The start made by the young cane crop has been distinctly more favourable than last year. There is, no doubt, a good deal of supplying still to be done in the fields last planted, but those planted earlier are regular and, in some instances, forward.

Even in districts which at this time of the year have completed the tillage and manuring of their young crop, both these are still in progress Large quantities of manure, both from the yard and field pens, are still being distributed, and draining and forking are also going on It would be more satisfactory if thorough tillage could be done earlier, but it is better late than never. It is impossible to estimate the value of exhaustive and intensive tillage. The particles of the soil are minutely divided, the air gains access, and the soil is rendered lighter and more permeable to the roots. The vegetable matter it contains decomposes more rapidly by a constant turning of the soil, and wherever the fibres of the roots penetrate they find organic food provided for them, and an abundant supply of oxygen of the air to aid in preparing it. We do not sufficiently realize how much the air assists in the fertilization of the soil. We can greatly enrich our land by having it thoroughly exposed to the atmosphere by deep and frequent tillage.

Reaping has been started, but is not so general as at this date last year. The canes are certainly not as ripe, and, as the crop is a lighter one, it is not thought necessary to force the pace. The density of the juice is not yet up to a good standard: 9½ is generally quoted. Practically all the windmills are at work, as their progress is naturally slower than steam power. All of these are making syrup, even where machinery for centrifugal muscovado had been installed. We may say that, outside of the factories, very little sugar will be made. The demand for liquid produce is strong, and a good price is being paid. We are of opinion, however, that the high price offered for molasses, Fancy and Choice, is to some extent the result of competition in the local market. The good price paid for syrup is enabling owners of estates on which this article is being manufactured to purchase canes from the peasants at apparently a better price than that offered by the factories. We have heard of one such estate which is purchasing at $7·00 per ton.

But little remains of the old yam crop for market purposes, and eddoes are very scarce. Potatoes are being retailed at 7 lb. for 10 c. An effort is being made to till the land from which canes have been recently removed, in order that potatoes may be planted. All depends on the weather. A small quantity of Indian corn has been reaped, and scattered here and there are to be seen fairly healthy plots of growing corn which, with showers at intervals, should develop satisfactorily. (*Agricultural Reporter*, February 9, 1918.)

COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended January 26, 1918, is as follows:—

ISLANDS. During the past two weeks there has been an active demand for the odd bags classing Fine to Fully Fine, resulting in sales of about 850 bales, at 73c., showing an advance of 1c. per lb. This demand has taken a large proportion of the offerings, and has rendered Factors firmer in their views, being now unwilling sellers, except at a further advance, which has not yet been paid. As the prices ruling here are relatively 1c. lower than those being asked for Georgias and Floridas, the mills requiring any supply were induced to place some orders in this market. The buying has been on account of the Northern Mills.

The limited demand for planters' crops of Extra Fine has not resulted in any sales so far.

We quote, viz:—

Fine to Fully Fine 73c. to 74c. = 75c. to 76c f.o.b. and freight.

Fine to Fully Fine, off in preparation, 70c. to 71c. = 72c. to 73c. f.o.b. and freight.

GEORGIAS AND FLORIDAS. There has been a very limited demand, resulting in small sales on private terms. The offerings are small and continue to be firmly held at quotations, notwithstanding that there is very little inquiry, the trade being apparently not interested This is the condition ruling throughout the interior markets, the holders of the cotton being also under the impression that they will be able to sell in time at very full prices, on account of the difficulty and uncertainty of getting Egyptian cotton to this country.

We quote, nominally held:—

Average Extra Choice 74c. = 76c. f.o.b. and freight.

The exports from Savannah for the past fortnight have been to Northern Mills 33 bales, and from Jacksonville to Northern Mills, 583 bales.

The United States Census Bureau report the amount of cotton ginned to January 16, as follows:—

South Carolina	6,234 bales	} making a total of 88,747 bales			
Georgia	45,651 ,,				
Florida	36,862 ,,				
against last year	115,463 ,,	total crop	113,109	bales	
,, 1916	90,736 ,,	,, ,,	85,278	,,	
,, 1915	79,484 ,,	,, ,,	78,857	,,	
,, 1914	76,188 ,,	,, ,,	85,544	,,	

The above report indicates a total crop of 90,000 bales to 91,000 bales.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and sixty-seventh meeting of the Council of the British Cotton Growing Association was held at the Offices, 15 Cross Street, Manchester, on Tuesday, January 8, 1918.

In the absence of the President (The Rt. Hon. The Earl of Derby, K.G.) Mr. J. S. Hoyle occupied the Chair.

WEST AFRICA. It was decided that the buying price in Nigeria should be fixed at 2*d.* per lb. of seed-cotton for the 1917-18 cotton crop, as compared with 1⅞*d.* per lb. which was paid last season. As in previous years, an extra price will be paid for the long staple cotton which is grown under the auspices of the Government Agricultural Department. It is hoped that this increase in price will induce the natives to extend the area under cotton.

UGANDA. The difficulties of shipping cotton from Mombasa are still very serious, and a considerable quantity of the 1916-17 cotton crop still remains to be shipped Representations have been made to the Government, and it is hoped that arrangements will be made for the shipment of the cotton, which is urgently required in Lancashire.

THE TOXIC SUBSTANCE IN COTTON SEED.

As was noticed in the issue of this Journal for January 25, 1918, p. 19, the nutritive value of cotton-seed meal has led to experiments, more or less satisfactory as to its being used in bread making in the United States and, on a small scale, in St. Vincent. The well-known fact, however, of a toxic property in the meal has naturally induced caution in the use of it as human food.

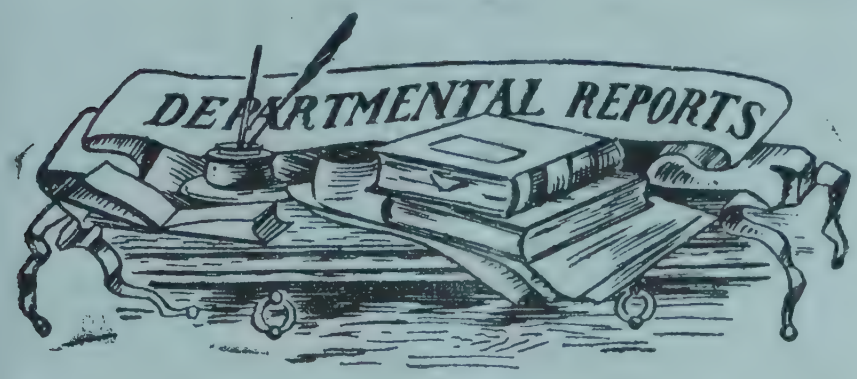
The results of investigations into this toxic property by Messrs. W. A. Withers and Frank E. Carruth, of the Chemical Division, North Carolina Experiment Station, are recorded in a paper contributed by them to the *Journal of Agricultural Research*, January 1918. Previous work on this subject by these two scientists was recorded in the same journal (November 1915), and noticed in the *Agricultural News*, Vol. XV, No. 358.

They find that the toxic property of cotton-seed meal is due to an active principle, which they name gossypol, and which is present in raw cotton-seed kernels to the extent of about 0·6 per cent. Gossypol is readily soluble in acetone and ether, and moderately soluble in ethylic alcohol. The extraction of the gossypol by ether rendered the remainder of cotton seeds non-toxic when fed to pigs, whereas the ether extract containing about 2 per cent. gossypol was highly poisonous.

It was found that cotton-seed meal was much less poisonous than raw cotton seed, owing mainly, in their opinion, to the oxidation of gossypol by the cooking during the process of manufacture.

The experimenters conclude that the toxicity of cotton-seed meal varies with the conditions of cooking the raw seed. Even after cooking for twenty-eight minutes there was still left in cotton-seed kernels 0·07 per cent. of gossypol, as compared with the original 0·6 per cent They are of opinion that thoroughly cooked cotton-seed flour and meal have no apparent toxicity for rats, when supplemented by milk powder in the diet, although inferior in nutritive value to cotton-seed kernels from which the gossypol has been extracted by ether.

It would seem, therefore, that it is possible, probably by a combination of extraction and cooking, to obtain a valuable foodstuff for human consumption from cotton seed, if also the seed is subjected to decortication for the purpose of removing the hard outer skin. Some such process is probably employed in the production of cotton-seed flour in Texas, where, it is said, it is increasingly being employed in bread making. An extension of such manufacture in all cotton-growing countries would materially add to food resources, if after further trials the resulting flour can be depended on as free from the toxic property which has hitherto prevented its use as a food.



SEYCHELLES: ANNUAL REPORT ON AGRICULTURE AND CROWN LANDS, FOR THE YEAR 1916.

This report by Mr. P. R. Dupont, Curator of the Botanic Station in the island of Mahé, the chief island of the group, contains most interesting details of agriculture in the colony, and also of its other resources, especially those bearing upon the agricultural interests.

From the list of plants, either already established or recently imported into the Botanic Station, it is easy to see that the conditions are very similar in that group of islands in the Indian Ocean to those obtaining in the wetter islands of the West Indies, which impression is borne out by the meteorological returns, the temperature ranging from 85·7° maximum to 75·5° minimum, the rainfall for the year being 99·29 inches, which however was 30 inches less than that of the previous year.

Among introduced plants, Mr. Dupont notes that the 'Gros Michel' banana flourishes since its introduction in 1912, and produces bunches of enormous size. Papaw seeds from Hawaii have been successfully grown, the seedlings fruiting six months after planting, and producing fruits from the very base of the stem, which strikes one accustomed only to West Indian varieties, as a very unusual trait in a papaw.

A tree, formerly very common in Mahé, is being reintroduced. About 3,000 plants, raised from seeds imported from Madagascar, of the gum copal (*Trachylobium verrucosum*) are being planted on Crown Lands. Besides yielding the gum of commerce, this tree affords good timber and grows quickly on even poor soils.

The extended cultivation of the oil-palm (*Elaeis guineensis*) is recommended as being specially suited to the soil and climate of the Seychelles. A bunch of nuts weighing 48 lb. has been taken from a tree growing at the Botanic Station. The palms also seem to begin to bear much earlier than in most places where they are cultivated, plants only two and a half years old producing nuts already. Mr. Dupont says that he does not recommend substituting the oil-palm for the coco-nut, which is the staple industry at present, but considering that the latter palm is very much attacked by many insect pests in these islands, it would be worth while to cultivate the oil-palm as an adjunct, on account of its suitability to the conditions, its productiveness, and the value of its crop. In connexion with the oil-palm, mention is made of the length of time which its seeds often take to germinate. Seeds received from Lagos in 1912 were still germinating in 1916.

It would appear that in some of the uninhabited islands of the group there are large and valuable deposits of guano, as these islands are frequented by myriads of sea-fowl. This source of increased fertility is being utilized to some extent, but Mr. Dupont warmly advises a much more extended use of it locally. It is also a source of revenue as an article of export, 34,720 tons having been exported in 1913; although the quantity fell to 980 tons in 1916 owing to difficulties of transport.

An interesting series of experiments on manuring coco-nuts is being carried on. The experimental plots are in duplicate of a series of six, and are subjected to the following treatment: (1) no manure, (2) green manuring with velvet beans, (3) green manuring plus guano (800 lb. per acre), (4) green manuring plus guano and coco-nut husk ashes (800 lb. per acre), (5) green manuring plus guano, ashes, and lime (1,270 lb. per acre), (6) fish guano (600 lb.) plus fresh sea-weed (3 tons per acre). The yield of nuts was carefully ascertained for the year reported on, in order to take into account the natural yield of each plot, and the yield for 1917 will also be treated as a natural yield, owing to the fact that the embryo leaves of the coco-nut, together with the subtended clusters of nuts, on which it is calculated that the influence of the manures will make itself felt, take two years and nine months to reach maturity. From the table of yields appended it is evident that, as Mr. Dupont points out, the productiveness of coco-nut trees in the Seychelles leaves much to be desired one plot giving an average of only eight nuts per annum; and although it is true that on another the average was thirty, that even is a low yield compared with the yield in most other places where the palm is cultivated. The total crop of coco-nuts of the colony for 1916 was estimated at 23,679,935, being about 2 million nuts less than that of 1915. The chief reason of the reduction in this crop seems to have been the ravages of insect pests.

The vanilla industry, which was not so long ago very flourishing in the colony, seems to have much decayed, due apparently to want of careful cultivation, and also, Mr. Dupont thinks, to the failure in vitality of the vines which have been reproduced constantly for fifty years by cuttings only. This renders them susceptible to a fungus disease which is very prevalent. He suggests the growing of seedlings to produce a fresh stock. He advocates the 'madre del cacao' (*Gliricidia maculata*) as the best tree for props and shade for the vanilla.

Owing to present high prices the rubber industry, which had practically been quite neglected of late years, appears to have been stimulated, and it would seem as if there were possibilities of a very considerable increase in the cultivation, especially if more care in planting the trees at proper distances is observed, and if tapping is conducted on the best approved lines.

Another industry which is steadily progressing is the distillation of essential oils, especially cinnamon leaf oil, the quantity produced of this in 1916 being 15,069 litres. This oil finds a ready market in England at remunerative prices. Oil of cinnamon bark and oil of clove leaves are also produced in largely increased quantities. The residues from the stills after distillation are employed as very valuable humus-forming manure, especially on coco-nut estates.

Another minor industry is mentioned in the report, that is the manufacture of citrate of lime on one of the islands. For this purpose the juice of the small bitter orange is used. The report states, however, that this fruit is becoming much lese common in the colony, the trees being infested with scale insects.

Mr. Dupont draws attention to the great waste of coco-nut husk fibre that takes place, and advocates a large extension of the manufacture of coir, as a means of utilizing the fibre of the husks.

Apart from agricultural products, the islands export guano, which has already been noticed, and several fishery products— whale oil, dried calipee, trepang, and shark fins, and a considerable quantity of salt fish.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

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Mycologist	W. Nowell, D.I.C.
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†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial is a reproduction of an address of Mr. Houston, the Secretary of Agriculture of the United States of America, which is very apposite to present conditions.

An article on Insect Pests in Barbados, as dealt with in the last report of the Superintendent of Agriculture of that island, appears on page 58.

Some notes on recent investigations with regard to diseases of Citrus trees will be found on page 62.

The food of the West Indies is the subject of an article on page 50.

Oil Industry of Trinidad in 1916.

According to the report for 1916 by the Acting Colonial Secretary of Trinidad and Tobago (*Colonial Reports*—Annual, No. 930), there were ten companies engaged in the production of petroleum in Trinidad at the end of 1916. The total output of oil in that year was 32,475,695 imperial gallons, as compared with 31,666,396 imperial gallons in 1915. Drilling to the extent of 58,390 feet was carried out during the year. Oil was struck in thirty-four of the forty-seven wells drilled. The total number of wells drilled in the colony up to December 31 last was three hundred and twenty-five. Several refineries have been engaged in the production of petrol, for which there is a large demand locally, as well as in some of the neighbouring islands. Kerosene has also been produced for local consumption. The value of crude petroleum, fuel oil, and petrol exported from Trinidad in 1916 was over £200,000, as compared with £79,000 in 1915, thus bringing oil into the third place of importance in the list of exports from the colony.

Introduction of Insect Pests to be Avoided.

The *Journal of Heredity* for January 1918, in a brief note on the necessity for increased production of foodstuffs, and the practice of war economies at the present time, emphasizes the importance of measures being taken for preventing the further introduction of insect pests and plant diseases into the United States. In this connexion it is mentioned that the Massachusetts Forestry Association, in *Bulletin 121*, has brought together some striking figures to show the loss annually caused by those pests and diseases which are already present in that country, and makes the startling announcement that the Bureau of Entomology of the Department of Agriculture has listed over 3,000 more insects which are found in foreign countries as pests, and although not yet introduced into the United States, may have to be contended with at any moment.

It appears, says the journal, that the insects which by a conservative estimate are costing the country $500,000 000 annually, are but a scattered vanguard of the myriads which are ready to follow at the first opportunity.

Undoubtedly the only possible prophylactic measure, as suggested, is to enact such legislation as will provide for keeping these pests out by keeping diseased importations out. It is not so much a question of keeping the plants out, as of how the plants shall be brought in, but without insects and diseases. Effective quarantining before the pest has secured a foothold in the country would do much to make the task of those who are producing the foodstuffs to win the world war less heavy. Quarantine measures on the lines of those indicated above have already been enacted in most of the West Indian colonies. Similar steps now being taken by the United States in reference to the importation of sweet potatoes and yams will be noticed in our next issue.

Tapioca Starch from Rhodesia.

Cassava or manihot (from the roots of which tapioca and tapioca starch are prepared) has been grown for several years past at the Agricultural Experiment Station, Salisbury, Rhodesia. The climate appears to be well suited for its cultivation, and 10 to 20 acres are being planted with the crop at the Government Experiment Farm, Gwebi. The roots, it is said, have been fed to stock experimentally without ill effects, and in view also of the existence of a South African market for tapioca, and the possibility of exporting cassava starch to Europe, the Director of Agriculture considers that the prospects of this crop for Rhodesia are good.

A small quantity of starch, prepared experimentally from cassava grown at Salisbury, was examined recently at the Imperial Institute. Microscopic examination showed that the sample consisted entirely of tapioca starch granules. A firm of importers in Liverpool, to whom samples of the material were submitted for valuation and report, stated that in their opinion the quality of the starch was good, and that the product would have a ready sale, provided the commercial shipments were equal to the sample. They valued the product at about £28 per ton less $2\frac{1}{2}$ per cent, ex quay Liverpool, war risks included.

The results of examination indicate that the present sample represented a fairly good quality of tapioca starch which, in the opinion of the *Bulletin of the Imperial Institute* (Vol. XV, No. 2), from which this information is obtained, should find a ready market in the United Kingdom, if offered in commercial quantities.

Electrical Stimulation of Crops.

Among the many uses to which electricity is now being put, perhaps one of the most interesting and far-reaching is its application to the stimulation of plant growth. In view of the increasing food shortage of the world at the present time, any means whereby stimulation of crops can be effected is of immense importance.

Many investigators are now in the field, and are obtaining distinct results. The English Board of Agriculture is turning serious attention to the question of the utilization of electricity in agriculture, and it is thought that by its aid the people of Great Britain may be made far more independent of imported food without calling on the scanty reserves of man power. From an article in the *Journal of Agriculture*, New Zealand, October 1917, it appears that experiments are being made in the province of Canterbury as to the stimulation of crops by electricity, both in glass houses and in orchards. The electric installation in a glass house 80 feet by 30 feet, in which 1,400 tomato plants were set out, consisted of fifteen 100-candle power nitrogen-filled lamps with frosted globes. The lamps, each provided with a 9-inch enamelled iron shade, were hung at a height of 2 feet from the ground, the area under the influence of each lamp being 100 square feet. The current was switched on each night at 9 p.m., and switched off at 5 a.m. each morning. As the height of the plants increased, the lamps were raised accordingly, until the tops of the plants completely enveloped them. Unfortunately there was no control to this experiment, but there was sufficient evidence, according to the article, to establish the fact that the electrical treatment resulted in a definite stimulation of growth, with a proportionate increase in the yield, the resulting crop being a very heavy one, and maturing relatively early.

The experiment on orchard cultivation consisted of attaching in the centre of each of twenty-four trees a 250-watt radiator lamp. In this case the crop of apples on these trees, in addition to being a heavier one than on others in the orchard, was ready for picking fully a fortnight earlier.

For use as a crop stimulant, electric power must of course be obtainable at a cheap rate. With the abundant water-power in New Zealand these experiments were conducted at a cost of $\frac{1}{3}d.$ per unit, which is very low. Most of the British and American experiments have been worked out on the basis of cost at $2d.$ to $5d.$ per unit, and, even at these prices, the electrical stimulation of crops is found to pay well.

The Guatemalan Sugar Industry.

Next to coffee, sugar is the most important crop of Guatemala. The chief sugar districts are all on the Pacific coast. There the chief varieties of cane grown are (1) the variety known as Jamaiquina, and (2) a variety planted extensively in the coast district, and known as Cristalina. The area devoted to the cultivation of sugar in 1916, according to an article in the *International Sugar Journal*, December 1917, was 76,352 acres. From a report by the United States Consul at Guatemala City, it appears that there are twenty sugar mills in the Pacific coast region, having each an average crushing capacity of 540 tons per day, along with several smaller mills. The machinery used is modern, and was imported mainly from the United Kingdom and Germany. The grades of sugar manufactured are 86° to 89° brown sugar, and 96° to 99° white sugar. The quality of sugar produced is declared to be excellent, and there is a large local market for the product. The sugar exported is principally the raw product known in Guatemala as 'Moscabado'. The exports of sugar from Guatemala in 1915 were valued at £67,000

Antigua Corn Granary.

From a report forwarded to this Office by the Superintendent of Agriculture for the Leeward Islands, it appears that after repairs and alterations the Antigua Government Corn Granary is now in good working order, and capable of producing, on an average, 800 lb. of corn meal per working day. The present difficulty is the little stock of corn in the island. Of the 2,672 lb. of corn ground in the three days, February 6 to 8, 1 025 lb. were sent from St. Kitts, to be returned as meal. It may be mentioned that the two bins attached to the granary have each a storage capacity of 1,600 bushels of shelled corn.

INSECT NOTES.

INSECT PESTS IN BARBADOS IN 1916-17.

The Report of the Barbados Department of Agriculture for the year ended March 31, 1917, has recently appeared as a supplement to the Barbados *Official Gazette* of January 24, 1918, and it is proposed to give some brief notes on those portions of the report which deal with insects.

The report of the Superintendent of Agriculture, Mr. J. R. Bovell, is occupied mainly with a list of the Acarina (mites and ticks) and Insecta of Barbados, except the Coccidae or scale insects, a list of which was published in the Report for 1914-15. The present list does not claim to be by any means complete, but it serves as a useful preliminary reference which can doubtless be added to from time to time. The report of the Assistant Superintendent of Agriculture, Mr. J. S. Dash, is concerned with the various crop pests, which are dealt with under the crop headings.

SUGAR-CANE. This crop has for many years been attacked by three pests whose combined onslaughts must cause considerable annual losses. Mr. Dash calls attention to the fact that two of these pests, the root borer (*Diaprepes abbreviatus*) and the brown hard back (*Phytalus smithi*), are on the increase, while the moth borer (*Diatraea saccharalis*) continues to cause a great loss every year. He urges the necessity for more general co-operation among the planters in carrying out measures for keeping these pests in check. As Mr. Dash points out, the campaign against insect pests should be one of the routine operations of estate practice. A certain annual outlay should be set aside for this purpose, and the benefits of increased yields would more than repay any such outlay expended in the right way. Hand-collecting of the various stages of these insects is very useful as a measure of control, but it must be supplemented by proper rotation of crops, otherwise much of the expenditure of labour and money is wasted.

Minor pests of sugar-cane are the mealy-bugs (*Pseudococcus calceolariae* and *P. sacchari*), and the scale insect *Aspidiotus sacchari*. Termites or white ants are also mentioned as occasionally attacking sugar-cane. A previous report recorded the species *Eutermes haitiensis*, Holmg., while this report mentions the finding of another species *Coptoltermes marabitanus*, Hag., as a minor pest of sugar-cane.

The cane-fly (*Delphax saccharivora*) has not been observed by Mr. Dash since 1914 when the egg-masses of this plant bug were found to be heavily parasitized by a minute hymenopteron, *Anagrus flavescens*. It was formerly considered that lacewing flies (*Chrysopa* sp.) and coccinellid beetles were the chief natural enemies of this pest.

COTTON. The presence of the leaf-blister mite (*Eriophyes gossypii*) was reported from some places, while small attacks of the cotton caterpillars (*Alabama argillacea* and *Aletia luridula*) are recorded. These caterpillars were controlled by the use of Paris green. The red maggot (*Porricondyla gossypii*) caused injury to cotton stems in one locality.

The larger importation of cotton seed into Barbados from outside to meet the needs of the two local oil factories has increased the danger of the introduction of foreign insect pests. Mr. Dash reports that many of these cargoes of cotton seed have been found on arrival to be insect-infested, and at least two species of Microlepidoptera, or small moths, and a Tenebrionid beetle have been intercepted. These have, in every case, he continues, survived fumigation with the method in vogue, thereby showing the necessity for the erection of an up-to-date fumigatorium if the cotton industry is to be protected from dangerous imported insects, such as pink boll worm, boll weevil, etc.

PROVISION CROPS. The scarabee (*Euscepes batatae*) has been recorded as prevalent in sweet potatoes in several districts, and the need of sound action against this pest is emphasized, especially in view of the present food situation. It may be mentioned here that the more important measures of control which are to be used against the scarabee were given in the last number of the *Agricultural News* (Feb. 9, 1918).

The red spider (*Tetranychus telarius*) was present on sweet potatoes during the dry months, but this pest is usually thrown off by the plants with the arrival of good rains. Dusting with equal parts of flowers of sulphur and lime is recommended for bad attacks.

Diaprepes abbreviatus is recorded as attacking young potato plants which had followed canes badly attacked by this pest. The grubs bored into the stems below ground, with the result that the plants so attacked were killed. This shows the danger of using sweet potatoes as a rotation crop after sugar-cane; a crop such as cotton or cassava, which is less liable to attack by the root borer, is recommended.

The leaf-hopper (*Peregrinus maidis*, Ashm.), was taken on sorghum leaves during the period under review.

MISCELLANEOUS. A number of insects are referred to under this heading, with short notes on their habits. These insects are given in the list of Barbados insects referred to above. The finding of a species of Peripatus is mentioned. An account of this interesting animal appeared in the *Agricultural News* for June 10, 1911 (Vol. X, No. 238). This will be referred to again at an early date.

J.C.H.

DEMAND FOR FISH SKINS.

In a note in the *Agricultural News* for October 6, 1917, p. 313, on industries in the Caicos Islands, mention was made of the utilization there of shark skins for making leather, which was said to be of good quality. From a letter received by the Imperial Commissioner of Agriculture from the American Consul in Barbados, enclosing one from merchants in New York, it would seem as if there were possibilities of some trade from these islands in fish skins of various kinds.

The merchants in question, Messrs. H. S. Berner & Co., of 25, Beaver Street, New York, write that they are prepared to deal with regular monthly shipments of large quantities of fish skins such as sharks, porpoises, whales, stingrays and other large fish skins without scales. They would contract for regular shipments of several thousand per month of these, or all they could get, if they could obtain an idea as to the quantity which could be supplied. Before ordering such large quantities they request that samples of the skins which might be supplied be sent to them, in order that they might see which would suit their purpose. Each skin of such samples should be marked so that they may state the quantities required of approved sorts. The skins must be large, preferably 4 feet in length or more. Small skins cannot be used very well, so the larger the better. They can also use whale intestines, for which they pay 3c. to 4c. a lb., c.i.f. in New York, for any quantity they can get. Directions are given for the preparation and packing of the skins or intestines.

Messrs. H. S. Berner & Co. also state that in the sample shipment might be included a few skins of large fish with

scales, numbered like the scaleless skins. They do not know at present if they can use these, but they desire to try them for some special purpose, and see if they can order a quantity of these also. Satisfactory arrangements regarding payment will be made, they state, after receipt of the sample shipment.

Now in the sea all round these West Indian islands there are many of the fish whose skins are asked for, and of which at present no use is made. In the bays and channels of practically all these islands sharks and sting-rays are plentiful. At a very short distance out to sea shoals of porpoises are to be met, especially in the deep waters close to the shore of the more mountainous islands. No effort is made to capture these at present, owing to their lack of value as food; but they might be caught doubtless in considerable numbers, if the capture of them was remunerative. Among the Grenadines there is a whaling business conducted, but as far as the writer knows no use is made of the skins of the whales. It might be worth while for some enterprising persons to attempt a sample shipment of these large fish skins, though of course neither whales nor porpoises are really fish.

But beside these scaleless skins it seems as if a trial shipment of some scaly skins of the many species of very large fish abounding in West Indian seas might lead to profitable results. The albacore, the bonito, the dolphin (*Coryphaena*), the Jew-fish, the king-fish, and the barracouta all attain to several feet in length. It is true that the flesh of all these is used for food, but one does not see why the flesh should not be sold just as readily after the fish is skinned as with the skin attached. Animals are skinned before the flesh is sold, and why not large thick-skinned fish whose flesh is sold by the pound in cut off portions. There are other thick-skinned scaly fish, though not attaining any very great size, whose skins might be found useful on the market, such as the grouper, and the old-wife. The skin of the latter is dried in several of these islands and used for scrubbing purposes on account of its toughness.

The fishing industry in most, if not all of these islands, could probably be largely extended, and if as a by-product of the industry, so to speak, the skins of the larger fish could be profitably sold, this might stimulate the fishermen to improve their methods and increase their catch. In the Virgin Islands, for instance, where a considerable number of the men are fishermen—who market much of their fish in St. Thomas—the profitable disposal of the skins would largely add to their otherwise very limited resources. In the Leeward and Windward Islands also the fishing industry is practically confined to the supply of the small local markets. In connexion with the small whaling industry existing in the Grenadines there are doubtless many men who would expand and diversify their work, if opportunities such as this under discussion can be developed.

Barbados has much more efficiently equipped and organized fisheries with larger boats and better appliances, owing to the fact that the flying-fish have to be netted some distance out to sea, and with them the dolphins hooked. Still much larger quantities of fish might be caught, and then preserved by salting or drying or canning, and thus help to solve the pressing question of the present— the food supply of the West Indies.

The following are the directions for the preparing and packing of fish skins for market, given by Messrs. H. S. Berner and Co., which they particularly request should be adhered to in shipments to them:—

'The skin when removed from the fish should be entirely free from flesh placed on the floor, backs down, and the entire surface of the flesh side covered with a thin layer of salt. The utmost care should be used in spreading the salt, leaving no space untouched, so that the back of the next skin spread comes in contact with salt only.

'The height of the kench or pile should not exceed 3 feet for thin skins of delicate fibre, and 4 feet for heavy skins.

'They should be salted for three to five days (depending on thickness) and would then be ready for shipment.

'The containers for their transportation must be cases or barrels. A case 30 inches long, 20 inches wide, 18 inches high (inside measurement) should hold 200 lb. The material could be of the cheapest quality of lumber, ends 1 inch, sides, top, and bottom ⅝-inch. The skins could be packed in these cases backs down, or each skin rolled up, but in either case care must be used to give them a slight sprinkling of salt on the flesh sides to prevent heating or sliming.

'Second-hand sugar, flour, fruit, and fish barrels can be used, but the fishermen or packers must be cautioned to examine these packages carefully for nail points on the inside of the barrels.

'The skins must be free from fork or hook holes.'

WHITE MAIZE.

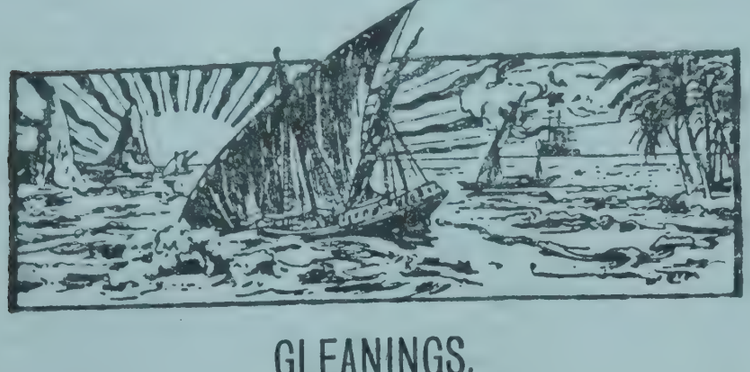
We have been informed that the shipment of maize lately received in Barbados from Venezuela is of a white variety. This is of interest for more than one reason. There is no doubt that one cause of the disinclination to use maize flour for bread making is its usual yellow colour. It is really only a matter of prejudice, since, providing that the material is perfectly clean, the colour does not have anything to do either with the taste or the value as food of a loaf. We are, however, to a great extent creatures of custom and slaves of prejudice. Therefore the conversion of maize into flour which looks white may conduce to its being used in bread making more widely in these islands. It may be remarked that in some of the formulæ for making corn bread given in the *Agricultural News* of January 26, white corn flour was especially recommended.

Another point of interest is the possibility of cultivating white varieties of maize in these islands. As far as the observations of the writer go, all the varieties of maize at present cultivated in the West Indies are of the yellow dent kinds. Perhaps this has also been a matter of custom and prejudice, seeing that the only use hitherto made of corn meal has been the making of cakes and 'couscous', the appearance of both of which is much improved by the yellow colour of the meal.

Of course, if the white varieties were not so prolific as the yellow kinds, or if they were not adapted so well to the climate and soil conditions of these islands, there could be no question of cultivating them. According, however, to Dr. Morgan, in his book 'Field Crops for the Cotton Belt' the white varieties are quite as prolific as the yellow ones, and white varieties are grown all through the corn-producing States, as far south as Louisiana, quite as commonly, if not more so than yellow kinds.

Now that the subject of the suitability of using maize meal for bread making is being so much ventilated, it might be well if planters and agricultural departments would test the suitability of some of the white dent varieties of maize to the conditions in these islands.

In any such experiments with white maize, it must be remembered that it must be grown quite separate from any yellow variety, and the two kinds not mixed either in the field or in the bin.



GLEANINGS.

According to *Nature*, January 3, 1918, Professor T. Johnson, of the Royal College of Science for Ireland, has introduced under the name of Inometer, a new form of food chart, constructed on the principle of the thermometer. The degrees on the scale represent large calories.

The gum of *Acacia arabica* is an important minor product of India. It is not the true gum arabic, which is obtained from *A. senegal*, but is the Indian gum arbic of commerce. The gum exudes spontaneously, or is procured by incisions in the bark, in the form of small lumps varying in form and size. A good tree is stated to yield about 2 lb. of gum a year. (*Forest Bulletin*, No. 35, India.)

Some interesting figures as regards the fish supply of Trinidad are given in the *Port-of-Spain Gazette* January 6, 1918. It appears that for the week ended January 4, there were sold in the market 40,396 lb. of fish Of this quantity 33,392 lb. were king-fish, which were sold according to size at 6, 12 or 16 for $1·00. A catch of this fish, amounting to 400 lb., which arrived at San Fernando, was sold at 10 for $1·00.

According to a report received by the Department of Trade and Commerce of Ottawa from the Canadian Trade Commissioner at St. Johns, Newfoundland, the colony's potato crop should exceed 2,500,000 bushels. This figure represents a supply per head for the year amounting to twice as much as is ordinarily consumed, so that there should be a considerable surplus available for seed purposes and for export to Europe. (*United Empire*, January 1918.)

At the Carrera Convict Prison in Trinidad the prisoners are engaged in various useful employments, mat making from coco-nut husk fibre being one of them. Locally, nearly all the stores, many of the churches, and a large number of motor car owners purchase mats from the prison. The industry has grown to such an extent that it is understood that hardly any mats are imported from abroad. On the contrary, St. Kitts and others of the smaller islands now import mats from Trinidad. (The *Voice of St. Lucia*, February 2, 1918.)

The United States has succeeded in establishing a successful dye stuff industry since the war began, and it is found that American dyes are as good as German dyes, according to a report made by the Bureau of Foreign and Domestic Commerce. Formerly importing annually as much as $10,000,000 worth of aniline dyes alone, the United States exported during ten months of last year $12,500,000 worth of dyes to foreign countries, and exports are growing rapidly. (*Science*, January 25, 1918.)

The area under rice in British Guiana for the year 1916 amounted to 57,000 acres. The total yield was 72,000 tons of paddy. The rice grown was of excellent quality: 13 000 tons of rice and 300 tons of rice meal were exported during the year. The very keen demand among planters of rice for the specially selected seed produced at the experimental fields of the Board of Agriculture steadily increased during the year. (*Colonial Reports*—Annual, No. 937.)

In Denmark a Government committee has been experimenting with the European stinging nettle as a source of fibre suitable for manufacture of textiles. It has been found possible to make from nettle fibre, fine rope, strong string, coarse linen, sail cloth, sacking, and binder twine. Sheets, cycle tyre covers, and fine material suitable for clothing can also be made, but have not as yet been produced in Denmark owing to lack of expensive, delicate machinery. (*The Board of Trade Journal*, January 3, 1918.)

The total production of rice in the United States of America was 2,000,000 lb. in 1866; it has now reached 350,000 000 lb. last year. Hundreds of miles of irrigation canals in connexion with this cultivation have been constructed. Rice has been the redemption of the prairie lands of Texas and Louisiana. (*Queensland Agricultural Journal*, December 1917.)

The principal export from Gambia is ground nuts. During the year 1916, 46,366 tons of ground nuts, valued at £506,098 were exported, less than half of the export of the previous year, but in consequence of higher prices the value was greater by £105,663. For the first time in the last fifty years the United Kingdom received a larger portion of the crop than was shipped to France. The export to the United Kingdom amounted to 22,374 tons, and to France, 19,313 tons. In 1913, out of a total crop of 67,404 tons the figures were 984 tons to the United Kingdom, and 42,420 tons to France. (*Colonial Reports*—Annual, No. 936.)

The *India Rubber World*, January 1, 1918, states that Egyptian cotton occupies the third place among long staple cottons, the true Sea Island being the first grade, and Georgias and Floridas the second. There are seven chief varieties grown in Egypt of which Ashmuni and Sakellarides form 90 per cent. of the yearly importations into the United States of Egyptian cotton. In length, Ashumi occupies the lowest grade, the staple being as a rule about $1\frac{1}{4}$ inches or less. It is brown in colour and not as clean and strong as the other varieties Afifi or Mutafifi forms the bulk of the Egyptian crop. The staple is very strong and regular, and $1\frac{1}{4}$ to $1\frac{3}{8}$ inches in length.

For use on their estates in Trinidad the Ste. Madeleine Sugar Company, Limited imported some pedrail wagons with the idea that they would be useful for getting canes out of the field in wet weather. The manager of the Ste. Madeleine Factory writes that in its present form the pedrail wagon, which is a flat tray-shaped box fixed on top of the pedrails, is unsuitable for the haulage of canes as it is top heavy and is apt to turn over even with a half load not only in the fields but in the traces. On muddy traces also the mud gets through the rails, and clogs the whole machine. They answer, however, splendidly on hard roads for carting gravel, lumber, or anything when the load is not piled too high, and one mule or two oxen can easily haul from 1 to $1\frac{1}{2}$ tons.

AGRICULTURAL EXAMINATIONS.

The three candidates in Antigua, who obtained certificates in the Intermediate Examination in Practical Agriculture held in November 1917, are:—

Name.	Result.
H. E. McDonald	3rd class
C. T. Michael	3rd class
V. G. Pariera	3rd class

The following were the questions set:—

I

GENERAL AGRICULTURAL SCIENCE.

A.

1. How may insects be classified in relation to the ways in which they feed; and how does such classification give indications as to the methods to be used for their control?

2. Give an account *either* (a) of the moth borer of the sugar-cane, *or* (b) of the cotton stainer, and of methods of control in either case.

3. Describe any two of the following: a fungus disease (a) of the sugar-cane, (b) of cotton, (c) of lime trees, (d) of Indian corn. State in each case methods of control advised.

4. What characters should be shown in a good variety (a) of cotton, (b) of maize?

B.

What do you understand by rotation of crops? What useful purposes are served by such rotation? Give your idea of a suitable rotation of crops on any estate you are acquainted with.

6. What is the usual method on any estate you know of making pen manure? Point out its advantages or defects.

7. What artificial manures are more suitable (a) for sugar-cane, (b) for cotton, (c) for Indian corn, in your island; and why are they suitable?

8. Discuss in relation to drainage the nature of the soil in the neighbourhood in which you live; if drainage is required, how is it best done?

C.

9. Give a description of two of the best fodder plants in your island.

10. Briefly describe an ordinary form of plough, giving diagrams to illustrate your description.

11. What kind of food, and in what quantity, should be given to a working ox or to a working horse?

12 Discuss in connexion with some one crop, such as cotton or sugar-cane, the general question of rainfall, indicating what may be beneficial and what injurious, giving reasons.

II.

SPECIAL CROPS.

A. Sugar-cane.

1. Describe how you would select and prepare cane tops for planting.

2. Discuss the question from a practical standpoint whether, with a definite area of cane land, it is better (a) to cultivate half in plant canes and half in ratoons, or (b) to cultivate one-third in plants, leaving one-third in ratoons and one-third in bare fallow.

3. How is the soil of cane land best maintained in good tilth?

4. What varieties of sugar-cane do you consider most suitable for the district you reside in? Describe the characteristics of *two* of them, and give reasons for your preference.

5. Describe briefly any insect pest of sugar-cane, state the damage it occasions, and any methods of control.

6. What methods do you consider the best in dealing with (a) cane tops, (b) cane trash?

7. Describe briefly the damage occasioned by any fungus diseases of the sugar-cane you have personally met with, and state any measures of control.

8. Outline briefly the system of cultivation best suited for ratoon canes.

B. Cotton.

1. Give an account of how you would prepare land for planting cotton. What precautions would you take (a) if the field were flat, (b) if the field were sloping?

2. What methods and precautions must be taken in picking cotton and preparing the lint for ginning?

3. What are the characteristics of a desirable type of cotton for your district? How can those characteristics be maintained?

4. Why is the destruction of old cotton plants necessary?

5. Describe 'internal boll rot,' its cause and its control.

6. How is cotton seed utilized in your district? Can any other uses be made of it; and if so, what are they?

7. Describe one of the following pests, stating any methods of control: (a) Leaf-blister mite, (b) Cotton stainer.

8*. Examine the sample of seed-cotton supplied to you, and report on its character and quality.

**This question must be attempted, if Cotton is a subject taken.*

C. Provision Crops.

1. What advantages are there in a crop of Guinea corn?

2. In planting yams, does the size of the set affect the development of the plant? How do you explain your answer to this?

3. In the cultivation of Indian corn, what production per acre ought to be aimed at? What measures would you take to obtain such a yield?

4. What benefits are to be derived from planting root crops such as yams, sweet potatoes, or eddoes as a rotation crop? What other crops would you use in rotation with such roots?

5 Describe any insect pest which attacks any root crop in your district. State its effects upon the crop, and what may be done to control it

6. Describe methods of storing maize for use (a) as seed-corn, (b) for food.

7. State approximately what ought to be the yield per acre of a sweet potato crop. Give any methods of storing or preserving sweet potatoes for any length of time.

8. State the methods employed in growing and harvesting a crop of onions.

DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture is leaving Barbados at the invitation of the Governor of Jamaica, with the approval of the Secretary of State for the Colonies, for a visit to that island. Sir Francis Watts is expected to be absent from Barbados for about three months.

Mr. A. E. Collens, Acting Government Chemist and Superintendent of Agriculture for the Leeward Islands, has been admitted to the Fellowship of the Institute of Chemistry of Great Britain and Ireland.

PLANT DISEASES.

NOTES FROM RECENT LITERATURE ON CITRUS DISEASES.

CITRUS SCAB IN PORTO RICO, J. A. Stevenson (*Bulletin 17, Department of Agriculture and Labour*).

Among the various diseases of grape-fruit in Porto Rico, citrus scab has beyond much doubt assumed a position of first rank. It is the chief agent in sending fruit to the cull pile and in the lowering of grades. The disease has been especially virulent during the past four or five seasons, and in some cases has disfigured and rendered worthless the larger part of the crop.

Citrus scab is an introduced disease which has probably come by way of Florida, and been present many years. It first appeared on sour orange and lemon, and remained practically confined to these two hosts, appearing only occasionally on young grape-fruit trees until the excessively wet season of 1911-12. In that period the grape-fruit was attacked suddenly and virulently in the Bayamon section, and the disease has since progressed without cessation, invading in turn most of the other citrus districts.

On sour orange and rough lemon the disease is so prevalent that it is quite usual for all the seedlings in nursery beds to be badly distorted and stunted; other varieties of lemon are reported to have been equally subject to the disease.

The lime and the mandarin have not been noted as susceptible to attack; the sweet orange is usually considered as immune, though a few cases have been seen of trees exposed to infection bearing scabby fruit, and the author considers it not at all unlikely that this species may lose its immunity at any time, as happened to the grape-fruit.

The Triumph variety of the grape-fruit is also immune, but its commercial defects prevent its adoption.

The disease attacks the fruit, leaves, and young twigs, producing first minute translucent areas, which are succeeded by the corky outgrowths characteristic of the disease. Often on the fruit these run together and cover a large part of the surface. Young fruit are frequently much distorted, and in some cases caused to drop. The affection is superficial only, and increases rather than diminishes the keeping quality of the fruit.

The cause of the disease is a specific fungus infection, spread mainly by rain and wind. Atmospheric conditions during and shortly after the flowering period determine the severity of the attack; wet cloudy weather favouring its development.

Unlike many plant diseases, citrus scab shows a decided preference for healthy vigorous trees, and actually avoids unhealthy or neglected trees.

The only known means of controlling scab is by spraying with a fungicide. Bordeaux mixture gives much the best results, but has proved in practice to have the great disadvantage of also destroying the fungus parasites of scale insects, and so leading to severe infestation of the groves. Lime-sulphur mixture is much less efficient, but is free from this objection, and is recommended for general use. In very bad cases it may be necessary to alternate with Bordeaux mixture.

So far as is known to the present writer, scab does not occur in any virulent form in the Lesser Antilles.

WOOD ROT OF CITRUS TREES IN PORTO RICO, J. A. Stevenson (*Circular 10*).

A serious amount of loss in Porto Rico arises from decay of the wood of fruit trees, consequent on the invasion of stems and branches by wood-rotting fungi which gain access by way of broken branches, pruning cuts, and the lesions of various primary diseases. The author feels assured that this type of trouble will play a most important part in the decadence of citrus groves in the not very distant future. Its effects are often laid to other causes, and action to prevent it is seldom taken.

It is interesting to note the statement that as a general rule the rebudding or topworking of citrus trees in Porto Rico has not been successful. The poor results obtained from a system which works well in other citrus regions are attributed to wood rot, following on sunburn of unprotected branches and trunks, and on untreated or poorly treated pruning wounds.

The adoption of advanced methods of tree surgery is not considered practicable under Porto Rican conditions. The recommendations made are (1) to attempt to treat only simple cases, (2) to replace badly affected trees, and (3) to concentrate on preventive measures. These consist in removing all dead material, sterilizing exposed surfaces with corrosive sublimate solution or Bordeaux paste, painting later with gas tar (from the use of which no injurious effects have been noticed), and renewing the coating periodically until the wound has healed.

ABNORMAL WATER RELATIONS IN CITRUS TREES, R. W. Hodgson (*University of California Publications in Agricultural Sciences*, Vol. 3, No. 2).

This and the publication referred to below represent attempts to secure by systematic experimental studies some definite and accurate information as to the physiology of the genus Citrus. Only by a thorough understanding of the relations existing between normal trees and their environment can one hope to find the underlying causes of the numerous obscure troubles classed as 'physiological' diseases, to which citrus trees in some districts are particularly prone.

The present study, referring to trees grown in arid districts in California and Arizona, deals with a phase of the excessive shedding of young oranges, known as 'June-drop,' which has been experienced for years in those districts. This annual loss of young fruit is most serious in regions where rainfall and atmospheric humidity are lowest, temperature and solar radiation highest, and air movement greatest during the growing season. A hot wave in June 1917, during which a temperature of 118° F. was reached, caused a drop so severe that practically the entire crop was lost in districts where shedding is not usually excessive. Following a reference to various published observations, including those of W. L. Balls on the cotton plant, on the daily deficit of water in the tissue of plants exposed to conditions promoting rapid transpiration, a deficit which commonly leads to something like definite wilting in the afternoon of each sunny or sunny and windy day, the author remarks that the effects of such temporary deficit may be expected to occur to an unusual degree when citrus plants, with a leaf structure adapted to somewhat humid tropical conditions, are grown in the dry interior valleys of California. With these considerations in mind it was thought that the shedding might be due to these irregularities in water relations resulting in abscission in some way analogous to the shedding of cotton bolls.

The most interesting of the results obtained from the experiments is the evidence they afford of strong negative pressures in the water column during the afternoon, so that it is entirely possible for the leaves to draw water back from the young fruits. The actual decrease of water in the fruit was indicated to be as much as 15 to 20 per cent., most of which is believed to be caused in the manner above described. The dropping of the fruit appears to be most severe when the water relations are most abnormal, and there is considerable probability that the shedding is a reaction to these conditions.

OPTIMUM MOISTURE CONDITIONS FOR YOUNG LEMON TREES ON A LOAM SOIL, L. W. Fowler and C. B. Lipman

(*Ibid.* Vol. 3, No. 2).

The conclusions reached are as follows:—

'In attempting to determine the optimum moisture content of a rather heavy loam soil for young Lisbon lemon trees grown in cylinders, at the Limoneira ranch, Santa Paula, California, the following information was obtained in the course of the first two years of the experiment:—

(1) A moisture percentage of 20 per cent. based on the dry weight of the soil has produced the tallest trees.

(2) Trees grown with 16 and 18 per cent. of moisture, while not as tall as those grown with 20 per cent of soil moisture, show better colour and more vigour. The differences are not very marked, however.

(3) The foregoing facts seem to show that the range of optimum or nearly optimum moisture percentages for the soil and plant in question is a relatively wide one.

(4) Much more visible damage results to the young lemon trees from moisture percentages in excess of the optimum than from those below the optimum.

(5) Every successive increment of moisture beyond the optimum is accompanied by a sharp depression in growth, colour, and general vigour of the trees.

(6) Every successive decrement of moisture from the optimum shows only a relatively slight depression in growth.'

W.N.

SORGHUM TESTS IN QUEENSLAND.

The London correspondent of the *North Queensland Register* sends us the following interesting note on experiments with varieties of Sorghum or Guinea corn in the tropical districts of Queensland. It is evident that this grain will prove to have as much value there as it has in other tropical lands:—

'Some interesting work has been done in Queensland by the State Department of Agriculture in experimental test-growing of non-saccharine and saccharine varieties of sorghums for seed and fodder purposes. Some of the returns obtained exhibit features of interest in relation to their important bearing on production.

'The non-saccharine sorghums are particularly valuable to Queensland in many ways. The grain is usually bold in character, and larger than the commonly known sorghums. The white-seeded varieties form excellent food for human beings or for stock, and the other more or less coloured kinds are good alike for poultry and stock, particularly for fattening pigs.

'This group of plants seems to be designed by Nature to reproduce themselves in the face of adverse seasons. They will afford seed where maize would fail to produce a p yable crop of grain, and they are undoubtedly prolific'.

A NEW PALM WAX FROM COLOMBIA.

A sample of crude wax obtained from the leaves of *Ceroxylon andicolum*, Humb. & Bonpl., the wax palm of the Andes, was recently forwarded to the Imperial Institute for examination and report. The palms, which occur only in western tropical South America, are stated to be exceedingly abundant, but no wax has yet been exported, although it is used in Colombia for making candles.

The sample in question consisted of fine powdered wax of a pale straw colour, with a small admixture of vegetable matter. After purification and removal of the vegeteble matter, the wax was analysed with comparatively satisfactory results. The purified wax was completely soluble in cold chloroform, carbon tetrachloride, benzine, or hot turpentine oil, but it was not completely soluble in cold alcohol, ether, or light petroleum.

As prepared, the wax was submitted to firms of manufacturers and brokers, who reported (1) that the material could replace Carnauba wax for many purposes. They stated, however, that its value would be considerably enhanced if it could be bleached, and that this process would also widen its field of possible application in industry. (2) A second firm stated that the product could certainly be employed industrially, and that its use was simply a question of price. (3) A firm of brokers stated that it was possible they might be able to place supplies of the material on the market as a substitute for Carnauba wax.

This palm wax when purified, is said to be similar in character to Carnauba wax, the product of another palm (*Copernicia cerifera*) which is collected chiefly in Brazil, and to the Candelilla wax obtained from a species of Euphorbia imported from Mexico, with the exception that its melting-point is higher. It should be readily saleable at the same prices as these waxes, which before the war were selling in the United Kingdom at £5 to £10 per cwt.

As it would be necessary to purify the wax before export, experiments were made at the Imperial Institute with the object of devising a simple method of purification, especially from vegetable débris. The following means were suggested:—

'The crude wax-dust, as collected, should be placed in a canvas or calico bag, and immersed in boiling water, the bag being weighted to keep it below the surface; most of the melted wax will then gradually pass through the fabric and rise to the surface of the water. A convenient device would be a strong canvas bag, the mouth of which is sewn or tied up after the bag has been filled with the wax dust. Two sticks, each with a slit in one end, can bs fixed easily along the top and bottom of the bag by means of screws. By twisting the sticks pressure is exerted on the canvas bag and causes the melted wax to pass through the canvas. The water with the layer of wax on top can then be allowed to cool. When quite cold the wax can be removed, powdered, and dried in the sun or in a warm place. The dried powdered wax should finally be melted in a deep vessel over a small fire, or better, in an oven at about 110° C., care being taken not to heat it longer than is necessary, or at a higher temperature than 110°C., as otherwise it will darken in colour. The remelted wax on cooling will be found to have deposited a dark layer at the bottom of the cake; this can be cut off and either sold as a lower grade of wax or worked up with the next batch of wax-dust. The cake thus freed from the dirty material will be ready for shipment.

The above information is gleaned from the *Bulletin of the Imperial Institute*, Vol. XV, No. 2.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, December 27.

ARROWROOT—No quotations.
BALATA—Venezuelan Block, 3/3¾; Sheet, 4/- to 4/1.
BEESWAX—No quotations.
CACAO—Trinidad, 94/- to 99/-; Grenada, 85/- to 96/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quatations.
HONEY—Jamaica, 134/- to 144/- per cwt.
LIME JUICE—Raw, 2/- to 3/.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—4¼*d.*
RUBBER—Para, fine hard, 2/9½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., January 15

CACAO—Venezuelan, $12·00 to $12·25 Trinidad, no quotations.
COCO-NUT OIL—$1·35 per gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—$7·70 per 100 lb.
DHAL—No quotations.
ONIONS—$8·00 per 100 lb.
PEAS, SPLIT—$12·00 to $12·50 per bag.
POTATOES—English, $4·50 to $5·00 per 100 lb.
RICE—Yellow, $11·50 to $11·75; White, 9·50 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS. & Co., January 15.

CACAO—Caracas, 12⅞c.; Grenada, no quotations; Trinidad, 13½c. to 13⅞c.; Jamaica, 9c. to 10¼c.
COCO-NUTS—Jamaica selects, $38·00 to $40·00; Trinidad selects, $36·00 to $38·00; culls, $18·00 to $20·00 per M.
COFFEE—Jamaica, 9¼c. to 11c. per lb.
GINGER—16½c. to 20c. per lb.
GOAT SKINS—Jamaica, 85c.; Antigua and Barbados, 75c. to $85c.; St. Thomas and St. Kitts, 70c. to 75c. per lb.
GRAPE FRUIT—Jamaica, $2·00 to $2·50 per box.
LIMES—$6·50 to $8·00 per brl.
MACE—31c. to 37c. per lb.
NUTMEGS—18c. to 21c.
ORANGES—$1·75 to $3·50.
PIMENTO—6c. per lb.
SUGAR—Centrifugals, 96°, 6·05c; Muscovados, 89°, 5·05c. Molasses, 89°, 4·85c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., February 6.

ARROWROOT—$9·00 per 100 lb.
CACAO—$12·00 to $14·00 per 100 lb.
COCO-NUTS—$28·80 husked nuts.
HAY—$2·90.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
SUGAR—Dark Crystals, $4.75.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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A Tropical University in Being.

THROUGHOUT the Empire at the present time the general question of education and technical training is receiving much attention. The Education Bill recently introduced into Parliament by the President of the Board of Education, and the Reports of the various Committees appointed by the Board of Trade are evidences of the feeling in the United Kingdom that in spite of the progress which has undoubtedly been made in education in late years, and especially in technical education, the position even there is far from satisfactory. Still more is this the case in the smaller dependencies of the British Empire. There technical education on scientific lines is almost unattainable.

For centuries Great Britain has been the great colonizing power, but cannot be said to have made full use of her opportunities as regards the provision of facilities for thorough and scientific education for the natives of her dependencies. The large self-governing members of the Empire have developed their own educational systems; and in the great Empire of India many colleges and universities have been founded in the interests of higher education, but doubts have been expressed for the most part whether these have been best suited to the Indian type of mind, or to the furtherance of the immense agricultural interests of that empire.

This is not to be wondered at, when it is remembered that the educational system in England is predominantly of a traditional and pedantic type. But there is certainly a change coming in the point of view from which education is looked at. It will no longer be considered that high technical training is necessary for those only who intend to enter the ranks of the three so-called learned professions, but that in every calling in life in which technical knowledge and skill are required, good training and the best technical instruction shall be obtainable. Particularly will this be the case as regards the science of agriculture, which, although a foundation of national prosperity, has been regarded in the past as worth acquiring only by rule of thumb.

For some years past there have been put forward from time to time suggestions as to the desirability of establishing one or more colleges in tropical parts of the British Empire for the scientific training of students in the principles and practice of tropical agriculture. Recently the movement has been more definitely focussed on Ceylon and Trinidad as

suitable centres for such colleges, and it is to be hoped that some adequate result will be reached in the near future from these movements.

Meanwhile, however, the Government of the United States of America has not waited long to utilize its position in the possession of tropical territories. The University of the Philippines, which has just completed its seventh year of existence, is an example of what can be done in providing an advanced type of education in all branches in the tropics.

In 1908 an Act, by the authority of the United States, was passed by the Philippine Legislature for the purpose of founding a university for the Philippine Islands, giving it a corporate existence, providing for a Board of Regents, defining the Board's responsibilities and duties, providing higher and professional instruction, and for other purposes. The Board of Regents were empowered by this Act to provide for the establishment of a College of Liberal Arts; a College of Law; a College of Social and Political Science; a College of Medicine and Surgery; a College of Pharmacy; a College of Dentistry; a College of Veterinary Science; a College of Engineering; a College of Mines; a College of Agriculture; a School of Fine Arts; and other Colleges for which the Legislature may provide by appropriation. The Board was authorized to open these colleges, or any of them, as soon as they should deem that conditions favoured such action, and funds were available for their maintenance. The sum of 1,000,000 pesos (about £200,000) was appropriated by the Philippine Treasury for the above purposes.

The first college of the University to begin work was the College of Agriculture, which was opened in June 1909, with fifty-six students. The number enrolled in June 1917 was 431, making this the largest college, except the College of Liberal Arts, which numbered at the same date 520 students. Of the colleges proposed to be established there are at present the following six: the College of Agriculture; the College of Engineering; the College of Law; the College of Liberal Arts; the College of Medicine and Surgery; and the College of Veterinary Science; with a total number of 1,574 students.

Besides these collegiate departments in which degrees are obtainable, there are also the following schools under the direction of the University: the School of Fine Arts; the Forest School; the Conservatory of Music; the School of Nursing; which grant diplomas. An additional 1,400 students are enrolled in these schools.

A staff of thirty-four professors, together with 165 lecturers and assistant professors and fifty junior assistants make up the teaching body of the University. It is evident that education of a high grade is within the reach of the Philippine islanders, and judging from the number of students, they are evidently taking advantage of their opportunities.

The arrangements of the College of Agriculture, and the course of study prescribed are of much interest in connexion with the question of the necessity for thorough and scientific training in this subject. The College occupies a tract of about 125 hectares of land at Los Baños, a village within easy reach by train or boat from Manila. The land is of diversified character, and permits of the cultivation of every important crop of the Philippines.

A large majority of the students live in club-houses, most of which are located in the College grounds. The College furnishes, free of rent, land for the houses, and oversees the sanitation and neatness of the premises. The clubs own their houses, and in part have built them, at an average cost of about 25 pesos a student. The cost of living in these clubs varies from 10 to 20 pesos a month.

The usual student activities in literary, musical and athletic directions are in full force: the students publish a monthly magazine, the *Philippine Agriculturist and Forester*, and there is a library containing standard books of reference, standard works on agricultural and kindred sciences, and a collection of publications on tropical agriculture.

Tuition in the College is free, and there are no matriculation or graduation fees, the College being supported by the Legislature.

There are two undergraduate courses: (1) a six-year course based on the intermediate course of the public school, and leading to the degree of Bachelor of Agriculture; and (2) a four-year course based on the high school course of the public schools, and leading to the degree of Bachelor of Science in Agriculture.

The obligatory subjects taught in the six-year course are, for the first two years, English, Mathematics, Rural Economics, and Botany, all with a careful view towards agriculture. Thus the subjects of themes or essays in English are matters of interest in agriculture and industrial economics; the lectures in Mathematics are specially directed to elementary surveying and the practical use of the compass, tape, transit, and level: Rural Economics consists of practical farm

work, in the shop with wood and iron, and in the field in the preparation and cultivation of land under various crops: it also includes book-keeping as it ought to be practised on a Philippine farm. For the third year the course retains Mathematics, and enters on Chemistry, Zoology, and Agronomy. The study of this last subject is continued until the end of the course; whereas for Mathematics and Zoology there are substituted in the fourth year Physics and Entomology. In his fifth year a student may select one course for himself, while for the last two subjects mentioned, Animal Husbandry and Rural Engineering are substituted. For the sixth year the only obligatory subject is Agronomy, the others being selected by the student.

The courses in Agronomy include practical daily work in all the operations on a farm, orchard, or garden, and, in the two last years, special instruction in the cultivation of tropical crops, and also in the principles of plant breeding.

The four-year course follows the same lines, but presupposes a higher standard of education to begin with, and for its completion there is required the presentation of a thesis representing a year's work on some agricultural problem.

That this College is producing good results is evident from the articles appearing in the College Magazine written by students, and giving evidence of thought and study. Practically, the output of many young men trained on these lines, who will be turning their energies into agricultural pursuits in the Philippines, must lead to continual advance in all agricultural matters in those islands.

As compared with the West Indies, the Philippines have much the same area, and contain not more than a million or so more inhabitants, but whereas the West Indies are politically split up among several nationalities, and speak at least three different languages, the Philippines are politically one, and speak only Spanish, although now the study of English is being encouraged. Still one cannot help dreaming and hoping that something like the Agricultural College at least of that eastern University may soon be seen in these western islands.

DEPARTMENT NEWS.

Mr. S. C. Harland, B.Sc., Assistant for Cotton Research on the staff of the Imperial Department of Agriculture for the West Indies, arrived at Barbados on March 1, on departmental business.

PROGRESS IN CO-OPERATION IN ANTIGUA.

In the Report on the Agricultural Department, Antigua, 1916-17, a general review of which appears on another page of this issue, there is an interesting account of the general progress made in that island on co-operative lines, much of which is here reproduced.

During the past few years a considerable amount of time and attention has been given by Agricultural Officers to the question of co-operation among planters. The first move of this kind made in Antigua was in the year 1904-5, when Gunthorpes Central Factory was erected. The working of this factory is well known, and comments on it in this report would be superfluous. Apart from this, however, there has been considerable activity in connexion with industries other than sugar-cane growing, and there exist in Antigua at the present moment, the Antigua Onion Growers' Association, the Antigua Cotton Growers' Association, and the Antigua Lime Growers' Association.

It was realized in 1916 that the work of these various associations would probably be furthered if a Central Board were formed, consisting of a representative from each of them, together with representatives from the Antigua Agricultural and Commercial Society. The outcome of this was the formation in November of the Central Board for Co-operative Organizations.

The object of this organization is to facilitate the spread of co operative enterprise in Antigua. It is within the power of the Board to deal with matters in connexion with co-operation not provided for by existing associations, as well as to co-operate with the existing bodies to secure development. It is within the power of the Board to raise money by loans or by other means, to embark in trading enterprises, to rent or purchase land or buildings, to appoint and organize sub-committees and meetings of private or public character, and to found and regulate organizations for co-operative purposes.

The Antigua Agricultural and Commercial Society during the latter part of the year 1916 referred to the Board, with the concurrence of His Excellency the Acting Governor, the question of the shortage of food supply. The question was taken up by the Board, and in order to obtain information as to the quantities of foodstuffs planted locally, and also in order to bring the seriousness of the situation home to the peasants, the island was divided into nine districts, each having its own Chairman. The Board was regularly informed as to the quantity of foodstuffs in stock, and the prospect of obtaining further supplies, and thus was kept intimately in touch with the situation as regards the local supplies of food. Planters were periodically circularized as to the area planted in provision crops, etc., and at the suggestion of the Board, Dr. Tempany compiled a leaflet on food values. This was subsequently printed, and widely circulated.

The committee has done a considerable amount of useful work in bringing home to the people of Antigua the seriousness of the position in connexion with food supplies.

This movement indicates that there is a lively spirit of co-operation existing among Antigua planters which is worthy of careful fostering. The following are some of the lines along which co-operation in the future may expand. There is the possibility of stock improvement by co-operation; the obtaining of estate supplies by co-operative organizations, and the introduction and furthering of new industries.

THE FOOD OF THE WEST INDIES.

The following is the conclusion of the article on the above subject by Dr. H. A. Alford Nichols, C.M.G., M.D., F.L.S., Senior Medical Officer of Dominica, the first part of which appeared in the last number of this Journal:—

It is better in every way for a country to be able to feed its own people on home-grown food, and to employ imported food products only in emergencies and as luxuries. A population dependent on imports for food may at times be in a precarious position, and another important consideration is that the money sent abroad for provisions would be available for home industries, not the least of which would be the raising of the food itself.

Of all the West Indian Colonies, Dominica has reached nearest the point of being capable of supplying the sustenance of its people by the products of the country. Mr. Joseph Jones, the Superintendent of Agriculture, in his report on the Botanical Department for 1916-17, says in regard to this matter: 'With the exception of Roseau, with its considerable population, the country districts of Dominica are self-dependent to a remarkable degree, and although the cessation of imported foodstuffs even for a short time would cause inconvenience, there is no community in the West Indian islands which is quite in so fortunate a position in regard to local foods as Dominica.'

There are several factors which together bring about this satisfactory condition of affairs. Dominica is a mountainous, well-watered island of large area, covered in the interior with virgin forests, so that there is an abundant rainfall, and the country never suffers from the severe droughts that sometimes occur in neighbouring islands. Most of the cultivated lands lie along or near to the seacoast where the greater part of the inhabitants dwell, but there are many settlements on the highlands of the interior. The greater number of the estates' labourers live in the towns of Roseau and Portsmouth, or in the numerous villages along the seashore. A considerable number of them, however, live up the valleys or on the hills, and they come down to the plantations daily to work.

Dominica is a land of small estates, and its peasant proprietors are very numerous. Many of the owners of the smaller estates, and practically all the peasant proprietors grow ground provisions and fruits, and rear live stock in sufficient quantities for their own needs, and also for sale in the markets. Most of the beef, mutton, and pork sold by the butchers, and the supply of milk and eggs, besides vegetable products, come from this useful and prosperous section of the agricultural population. Pigs are raised in large numbers by the peasant proprietors, who often pickle the flesh for future consumption.

Many of the labourers rent 'gardens' on the outlying lands of the estates, in which they grow vegetable foods for themselves and their families, as well as for sale. The people dwelling in the coast villages obtain an abundant harvest from the sea. Most of the fish is eaten fresh, but a quantity of the smaller kinds is slit open and salted, and dried in the sun for future use.

The forests contribute in no inconsiderable degree to the food supplies of the people. Indigenous animals—the agouti (*Dasyprocta agouti*), a large rodent, and the manicou (*Diadelphys* sp.), a marsupial—are fairly abundant in the woods, and their flesh is eaten both fresh and smoked. Game birds, too, are obtainable in the shooting season; and a big edible frog (*Leptodactylus pentadactylus*) and several kinds of land crabs are found aback of the coast lands.

The forest vegetable food products are important additions to the food supply. There are three kinds of wild yams the waw-waw (*Rajania pleioneura*), a closely allied specie known as the cush-cush, and a third yam, called baba-ou-l or cap-la-ou, which is an undetermined species of Dioscore probably escaped from cultivation. A fourth food-plant i a Calathea (*C. Allouya*), which is called topie tambou. Thes foods are fairly plentiful, and they are eaten largely b the people in the country districts. The waw-waw or Cari yam, as it is often called, is sometimes sold in the market o Roseau, and it grows to a large size; but the people are s anxious to secure it that they dig it up long before it i fully developed. It has recently been analysed in th Botanical Department of Dominica, and its protein conten was found to be as high as 3·58 per cent.

Thus the people of Dominica are really well off fo native foods as compared with the populations of the neigh bouring islands, in which most of the land is taken up b the estates of large proprietors, and in which the local food have to be more largely supplemented by imported wheate flour, and salted fish and meat.

The Hon. W. H. Porter, I.S.O., the Treasurer of Dom inica, has been good enough to furnish me with figures show ing the consumption per head by the population of the islan of the principal items of imported foods. His figures ar calculated from the imports of 1916 divided by the popula tion of 1915, and they are as follows:—

Consumption per caput per annum.

Wheaten flour	89·50 lb.
Rice	10·52 ,,
Salt fish	13·90 ,,
Salt pork	2·35 ,,
Salt beef	0·61 ,,

Mr. Joseph Jones, in his report already referred to, state that 'Dominica is self-supporting to a much larger exten than Antigua and St. Kitts, the only important article o imported foodstuff being wheat flour.'

As might be supposed from this fortunate position i regard to the home production of food, the labourin population of Dominica bears favourable comparison with it neighbours as regards vigour and health.

Some of the people dwelling in Roseau are of poo physique, for, owing to difficulties of transport, much of th surplus ground provisions of the country districts cannot b brought to town except with difficulty, and sometimes a a prohibitive cost; so the townspeople have to pay muc higher rates for their native food, and to supplement i largely by imported wheaten flour and salt fish.

Thus the poorer town dwellers, and those who are pas work find it extremely hard to obtain proper nourishment i sufficient quantities. Fortunately, however, these peopl form only a small part of the island population which, a has been shown, obtains sufficient nourishment containin the necessary elements for providing energy, and for buildin up the body tissues.

It is found that the ordinary labourer is not deficient i power to do continuous hard work. My observations som years ago on my own estate taught me that the agricultura labourer was fully capable of performing his daily task, an that there was no undue exhaustion. Mr. George Branch, th Manager of the lime estates of Messrs. L. Rose & Co., Ltd., wh is probably now the largest employer of labour in the island informs me that the people are quite capable of doing a ordinary day's work, and that in this respect many of them are 'hard to beat'. He finds, too, that those who come fro

the interior are, on the whole, better and stronger workers than those from the town.

Although the Dominica labourers live mainly on the food of the country, they are remarkably free from deficiency diseases. Pellagra and peripheral neuritis are exceedingly rare in the island; and, most of the few cases I have seen in recent years gave a history showing that the disease was contracted in one of the neighbouring colonies.

This practical immunity is due to the fact that the food of the people contains abundance of vitamines; although at times and in certain instances it may not contain what until recently has been considered the proper proportion of protein.

THE MEANING OF FOOD VALUES.

A food may be defined as a substance which, when absorbed by the body, either supplies material to restore tissue-waste, or which supplies energy, or serves both of these functions.

If a foodstuff is analysed it is found to consist of:—

Nitrogenous bodies—proteins,
Carbohydrates,
Fats,
Mineral salts,
Water.

Of these, the proteins, mineral salts, and water acting together, can alone restore tissue-waste.

The proteins also have another valuable property, namely that of producing energy, which property they share with the fats and carbohydrates. In brief, then, the proteins are double foods in that they both restore tissue-waste and supply energy, while the fats and carbohydrates supply energy alone. It is therefore evident that proteins are indispensable, whilst the other two great groups, though of great advantage, can on a pinch be done without.

There are substances in foods which are neither tissue formers nor energy producers, but which cannot well be dispensed with, namely the mineral salts and indigestible residue. The former are required for the body chemistry, and the latter plays the important part of ballast—that is, a sufficient bulk of material to stimulate intestinal action.

The term energy, in speaking of foods, is used in its mechanical sense. This energy is convertible into heat in the body, and by means of it the body can perform work. A simple illustration may be given. During its growth, a tree collects its energy from the sun's heat. It is cut down and burnt; in the burning its energy is reconverted into heat; this hea tmay be used to generate steam, which can do work in the shape of driving a piston. Instead of a tree let us take a potato; it too collects energy from the sun's heat, it is eaten and burnt up in the body, giving off heat which is used to produce the energy necessary to enable the body to do work.

The unit of energy as applied to human food is called the large Calorie, and approximately represents the amount of heat necessary to raise 1,000 grams of water 1°C. in temperature.

It is necessary briefly to mention this point, as all calculations on food value are based on it.

The energy of the chief constituents of food are:—

1 gram proteins	yields	5·6	Calories
1 gram carbohydrates	yields	4·1	Calories
1 gram fats	yields	9·4	Calories

The proteins and carbohydrates are quicker in action than the fat, but have not their staying power, so to speak.

Taking results that have been obtained from the most recent investigations in regard to food energy necessary for various degrees of work in a normal adult man of about 150lb. weight, we have the following:—

At rest, about 2,000 Calories per day.
Moving about, but no active work, about 2,300 Calories per day.
Moving about, and light sedentary work, about 2,500 Calories per day.
Moving about, and moderate mechanical work, about 3,000 Calories per day.
Moving about, and active agricultural work, about 3,500 Calories per day.
Moving about, and very active physical work, about 4,500 Calories per day.
Moving about, and extremely hard physical work, about 5,000 or more Calories per day.

These results are obtained by figuring a man's day as composed of various activities incident to it, e.g. eight hours sleep, at 65 Calories per hour; two hours for meals, going to and fro, at 170 Calories per hour; six hours sitting, at 100 Calories per hour; eight hours of labour, at from 170 to 600 Calories per hour, depending upon the degree of activity.

It may be mentioned that, according to Dr. Chamberlain in his book 'Organic Agricultural Chemistry' all efforts to determine the energy expended in even the most severe mental work have failed.

Not only, however, does the human body require a certain amount of energy to be supplied in food, but the food must also contain a certain minimum amount of protein. Food protein is essential to the formation of body protein; used up muscle tissue must be replaced by protein supplied in the food. Apart therefore from the energy supplied by the protein in food, a certain amount of protein has to be regarded solely as building or rebuilding material. Thus, although the minimum energy requirement of 2,000 Calories per day for a man might easily be supplied by carbohydrates or fats alone, yet, except for a short time, such non-protein food cannot meet the needs of the body for the replacement of used up tissue. The amount of the protein requirement for an average man of 150 lb. weight is usually given as 100 grams per day, though some investigators reduce it to 70 grams or even less.

The figures given above show that increased muscular activity raises the energy requirement from 2,000 to 5,000 Calories per day. In contrast to this, the fact is that increased muscular activity has only a slight effect upon the amount of protein needed for tissue building.

Sweet Potato and Yam Quarantine in the United States.—According to a notice recently issued by the United States Secretary of Agriculture, the importation of sweet potatoes and yams (*Ipomœa batatas* and *Dioscorea* spp.) into the United States from all foreign countries is now forbidden, except for experimental or scientific purposes. It is provided, however, that the entry for immediate export, or for immediate transportation and exportation in bond of sweet potatoes and yams may be permitted.

This quarantine became effective from January 1 1918, and has been established to prevent the further introduction into the United States of the sweet potato weevils (*Cylas* spp.), and the sweet potato scarabee (*Euscepes batatae*), which are prevalent in various parts of the world.

This notice of quarantine is not to apply to the territories of Hawaii and Porto Rico.

THE QUESTION OF PURE STRAINS OF COTTON IN EGYPT.

The following letter by Mr. John W. McConnel, of Manchester, is reproduced from the *Textile Mercury*, of January, 19, 1918. Into the merits of the controversy we do not at present propose to enter, but the matters discussed are of intense interest to workers in the improvement of West Indian cotton and will not be without their appeal to cotton planters in general:—

It is probable that comparatively few of your readers ever see the *Agricultural Journal of Egypt*. It is however the official publication of the Egyptian Ministry of Agriculture, and consequently what it says about cotton is of real importance to Lancashire. The issue, Vol. VII, 1917, just published, contains a report by the Botanist on his work on cotton during the year 1915. This occupies about 108 pages, and is followed by some 8 pages in the editorial notes, in which some information is given of the reports by spinners and others on the four cottons, of which the first pure strains were separated by Dr. W. Lawrence Balls when occupying the position of Botanist.

These reports on the samples are apparently printed for the purpose of throwing doubt on the favourable reports made by spinners, and indeed also by the broker. But whatever may be the exact object of the editor in printing these more or less confidential reports and stigmatizing them as 'rather contradictory,' it does not seem to be a very courteous reply to those spinners who have hitherto put their machinery and personnel at the service of the Agricultural Department. What, however, is of much more importance is that both from the editorial remarks, and from the opening sentences of the Botanist's report, it is evident that there is a definite intention to return to the antiquated practices by which in former years successive strains of cotton in Egypt have so sadly deteriorated.

The Botanist speaks of work previous to 1915 being conducted 'solely on Mendelian principles,' with unsatisfactory results. It is difficult to know what this means. Again the Botanist raises a curious kind of issue between the introduction of new strains and the improvement of existing ones. He does not explain what is meant by a new strain of cotton, nor yet how an old strain can be improved. Is the Mendelian theory to be taken as the basis, or is it to be ignored? It seems hardly possible at this time of day to ignore it. Surely in an attempt to develop plants for the practical service of man, some system of scientific law must be followed. It would be interesting to know at what point the Botanist thinks Mendel's law to be incapable of application to cotton. It is not, however, the object of this letter to discuss the questions of botanical science that seem to an outsider to be so curiously touched upon in this issue of the *Agricultural Journal*. There are two other matters, or perhaps other aspects of the matter, on which I desire to say something, because of their importance to the proper understanding of the need for research in raw cotton.

(1) What do spinners really want?

(2) Are the reports on samples made by spinners of any value to the grower?

As regards the first question, it must be remembered that there are many different branches of cotton spinning. Not only are there wide differences in counts, but there are other differences, such as those between twists and wefts. Sometimes colour is important, sometimes everything else may be sacrificed to strength: sometimes cleanliness is the main requisite. Therefore, that the editor should speak as he does of Sakellaridis, as meeting all requirements in Egypt, is itself a grave danger to the industry. It is true, of course, that Sakellaridis has many features which are attractive to the grower, but what follows from this is that any cotton which is also wanted by the trade must also be attractive to the grower. Cottons which will only command a lower price than that of Sakellaridis will have to be better in yield, better in lint percentage, as good or better in earliness. Is it not the proper function of the Agricultural Department to find out how to produce these results? On the other hand, it is obvious to any student of the economics of cotton that there is just now an urgent need for some new supply of really fine stapled cotton to take the place of American Sea Island when the boll weevil has destroyed it. For this purpose Balls's 310 was at any rate so promising as to deserve further investigation and perhaps further development. But for such cotton as this a higher price would have been paid, and a useful study for the Agricultural Department would have been the equivalents of price and quantity for such a cotton as compared with Sakel. Unfortunately this has not been recognized by those in charge.

In this connexion it will be remembered that when the Sakellaridis cotton first came into general cultivation on a large scale strong recommendations were made by spinners and other authorities that it should not be grown so extensively as to crowd out all other cottons. It is a cotton with many and great merits, but it is undoubtedly not the cotton that the Bolton mills want as the sole product of Egypt. If, then, it is desirable that Egypt shou'd grow some other cottons as well as Sakellaridis, is it necessary that these should be new strains? This cannot be answered without defining what is meant by a new strain. It is clear that when a different kind of cotton is introduced as an exotic into any country this may be spoken of as a new strain. Thus the American Uplands and some Egyptian types have been introduced experimentally into India and into different places in Africa. Also the Egyptian Mitafifi has been introduced into Arizona, and there developed into a cotton equal to or better than Sakellaridis. These are all obviously called new strains. But this is not the kind of thing that has been done in Egypt. The history of cotton in Egypt during the last half century is broadly that one kind or several closely kindred kinds have been for a time satisfactory, that each in turn has gradually or rapidly become poor, and that the general good quality of Egyptian cotton has been maintained or raised only by the more or less accidental discovery of a special plant which has bred true and has yielded an improved stock for general use. Thus spinners of mature years will remember the great attractions presented when they first appeared by Gallini, Mitafifi, Yannovich, Nubari, and finally by Sakellaridis, not to mention Abassi and Voltos. Now if these are what the present Botanist calls new strains, it is quite clear that Egypt in the past has absolutely depended on the finding of a new strain just in time to replace the deteriorated cotton of the moment. If, on the other hand, these are what he speaks of as improvements of existing strains, then it seems that he and the editor might well have refrained from speaking of Dr. Balls's varieties as if they had been something strange, and therefore abhorrent to spinners. Dr. Balls's varieties are, all four, true-born children of the Egyptian family; 310 is so much finer that it may claim a more secluded walk in life, but the other three—77, 95, 111—do not differ from the usual type in any other way than did the various new or improved types named above. The claim made for Dr. Balls's varieties was that they were pure, and

therefore, if kept pure, would supply for all time cottons of a regular and trustworthy character. It is truly unfortunate that this so far unique achievement in cotton growing should have been wrecked by the scientists at present responsible for the quality of Egyptian cotton.

Let us turn now to the other question. Are the reports on samples, made by spinners, of any value to the grower? There is a theory put forward occasionally that the only indication of merit which should guide the grower is the price which can be obtained, and further that in the matter of samples, the best guide for the grower is the cotton broker's valuation. There is an appearance of truth in these sayings, but the real defect of all this kind of talk is that it ignores the possibility of there being made any scientific analysis of the characteristics of cotton which produce particular results in yarn and in manufactured material. If nothing can be known of the real nature of cotton in use, or again if nothing can be done to modify the cotton of a district or country so as to make it better in some characteristic or another for its purpose—then certainly, why need we trouble at all? We might even do without the expense of Botanists in our Agricultural Departments. But surely there is a promise of better things than this in the years to come.

It is true that in examining small samples of cotton we have many difficulties. First there is inaccuracy. Samples are sometimes labelled badly even by the scientific people. The people in our mills, on whose unrecognized care and patience every detail depends, are not trained observers, and have many other duties to perform, and mistakes may sometimes occur. Again much judgment is required. Machinery has to be set to suit the cotton in use. It is a delicate matter to set correctly for a small sample, and incorrect setting may falsify the result. Such a cotton as 310, for example, requires to be worked among its equals, the Sea Islands: and if put through machines set for Mitafifi or other robust but short cottons would be condemned as in fact it has been sometimes. Yet much has been already learnt by testing samples. It is a truism to say that it is the spinner's verdict about a cotton that eventually decides its value. It is also a truth to say that all spinners, and at any rate most brokers, are continually, though for the most part unconsciously, modifying and correcting their judgment of cotton in the light of the lessons they learn from cotton in use.

What is wanted in the future is to elaborate the organization for testing samples. It is at present impossible to make these tests anywhere else than in ordinary mills. But the control of the sampling must be in scientific hands. It must, of course, be absolutely impartial, but besides this it must be accompanied by accurate examination of single fibre characteristics. Of Dr. Balls's three cottons, 95 is generally judged to be shorter than 77 or 111, yet it has invariably made the strongest yarn. The reason for this is not known; it will be one of the duties of the Cotton Research Association to ascertain why some cottons make stronger yarn than do others of greater length. It is proper to add here that many tests have been made of these three cottons grown in different places and under different conditions. The results have not been, as the editor thinks, contradictory, but quite extraordinarily uniform.

Another thing that will be necessary, if satisfactory results are to be obtained by testing samples, will be to have the records properly kept and indexed. Some West Indian cottons have now been tested for several years, and progress noticed. The scientists in Egypt tell us that they sent their samples on one occasion 'marked with numbers instead of the usual indications.' This is the kind of silly precaution which will have to be foregone in the future if our scientific work at home is to be made of use to scientists working on the growth of cotton. In the operations by which the cotton is cleaned and spun, and again, in all the testing and examination, prejudice must be and is always avoided by working under numbers, but to make the practical tests useful it is necessary that all available information should be given to the scientist in charge. Co-operation between scientists at home and abroad is impossible without mutual confidence.

It is to be regretted for many reasons that the scientific study of cotton in Egypt, so promisingly begun by Dr. Balls, should have been interrupted, but I trust that thoughtful people in Lancashire will not jump to the conclusion that all scientific work in cotton breeding is consequently useless. It will be one of the advantages of a strong Association for Research, of which practically all spinners are members, that it will put an end to certain petty jealousies which have retarded progress in the past, and will speak and act with authority that has necessarily been absent from the efforts of individuals.

AGRICULTURE IN BARBADOS.

February has been a showery month in most districts. Although the total rainfall for the month will probably not exceed that for February 1917, the character of the weather has been more favourable for the starting of the young crops.

The lighter crop, combined with the highly remunerative price of syrup, will cause a smaller output from the factories this year than last year. And it will be remembered that last year the amount of sugar made by the factories turning out crystals was 5,000 tons less than the output in 1916. We believe that it is gradually dawning on the planting community that the present factory system, or rather lack of system, is very imperfect. No doubt what has been done is a great improvement on the old system of sugar manufacture, but we are still some way off from what is being done in up-to-date factories. In future nothing less than a 14-roller mill should be put down with every accessory for the recovering of the highest percentage of sugar content and with every labour-saving device. In connexion with the improvement of our factory system we should also include the sugar chemist. His knowledge is very necessary, if loss in manufacture, even with the most up-to-date equipment is to be avoided.

We are very glad to be able to report that the young crop is everywhere growing well. In many fields several shoots are to be seen in each hole, and the recent showers will be of great help where there may be any irregularity or backwardness.

The provision crops have shared in the benefit bestowed by the recent showers, notably Indian corn, which has been largely planted. Too much of this cereal cannot be sown at the present time, and all that is grown, however great the quantity, could be disposed of at a remunerative price. A good deal of the meal being sold in the groceries has been made from corn imported from St. Vincent and the Argentine. The same could be done with corn grown locally.

In the black soil, land is now available for tillage for potatoes. We suggest that on every red soil estate a field of second or third ratoons be cut, if even not quite ripe, so that foodstuffs may be generally planted with each rain.

The price of potatoes has been fixed at 7 lb. for 10 cents. (The *Agricultural Reporter*, February 23, 1918.)

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
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Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial draws attention to the work of the University of the Philippines, especially in relation to Tropical Agriculture.

The value of quassia extract as an insecticide is discussed under Insect Notes on page 74.

Under Plant Diseases on page 78, will be found an account of the control of cacao canker in Java, and some notes on plant diseases in Barbados.

The article on food in the West Indies is concluded on page 68.

Rainfall in Dominica in 1917.

Copies of rainfall returns of Dominica for 1917 have been forwarded to this Office by Mr. Joseph Jones, the Curator of the Botanic Gardens. From these it appears that the mean rainfall for thirty stations was 110·53 inches—for thirteen Leeward Coast stations, 88·67 inches; for three Windward Coast stations, 123·90 inches; for eight Inland stations, 149·30 inches; for six Lasoye stations, 99·49 inches. The highest total recorded was 199·50 inches at Corlet, an inland station; and the lowest, 56·92 inches at Batalie on the leeward coast. Compared with the rainfall of the two previous years, that of 1917 is considerably lower than the average. In 1916 the mean for thirty-three stations was 125·70; and in 1915, for thirty-four stations, 137·11.

Progress in Combating Hookworm and Malaria.

According to a note in *Science*, November 30, 1917, the annual report of the Rockefeller Foundation states that during the year 1916, in co-operation with the Governments of the respective countries, systematic efforts towards control of hookworm have now been inaugurated in eight of the Southern United States and in the fifteen foreign countries situated in the tropical and subtropical belt between the degrees of latitude 36 North and 30 South, which is the native habitat of the hookworm. During the year reported on, preliminary infection surveys were made in British Honduras and in Barbados. Active measures to control and prevent hookworm disease are now in operation in Antigua, Grenada, St. Lucia, St. Vincent, and Trinidad, of the West Indies, and also in British Guiana.

The Board conducted during the year a series of experiments in malaria control. The object of these experiments was to determine the degrees to which malaria could be controlled within the limits of reasonable expenditure, and under conditions prevailing in typical farm communities of the south. Gratifying results have been obtained.

An experiment is being conducted as to the practicability of malaria control by detecting the human carriers, and freeing them of the malaria parasites. Communities with an average population of a thousand were dealt with one after another, the work in each lasting about four weeks, with subsequent visits to ensure thoroughness. In these the blood of individuals was tested, and those found infected were treated with quinine.

Research Work and Applied Science.

The Presidential address delivered to the Röntgen Society on November 6, 1917, by Captain G. W. C. Kaye, is reported in *Nature*, January 31, 1918. The chief subject of the address was the important use made of X-rays in military hospitals during the war. In concluding, the President emphasized the value of applied science to industry which, he said, was now thoroughly accepted by the British public; and British industry should begin to feel the benefit, especially now that the principle of State-aided research has been established.

He went on to point out that it must not be forgotten that pure academic research, unrestricted and unprescribed, has been the prime cause of all the radical changes in industrial methods. Research in pure science is rarely appreciated by the general public or the manufacturer, for it cannot be done to order. One must put faith in the research worker that he may continue to have faith in himself. Much of what he will do will be discontinuous and abortive, but he must not be hampered by utilitarian notions being continually rammed down his throat. If he does not solve the original problem he will probably solve some other which has sprung from it, and one successful discovery may far outweigh all his failures.

The equal importance of the applied research worker, who is responsible for turning to account the discoveries of the pure investigator, must not on the other hand be lost sight of. There is no line of demarcation between the two divisions of research. Each devolves study, hard work, and thought. The methods of both branches are questioning and searching; the common end is knowledge, to which there is no short cut.

The war is bringing home to the nation the dependence of its very existence on science, and a little good may come out of a very great evil, if public opinion can be brought to realize that a nation's administrators, as well in peace as in war, should always include among them suitable men of the highest technical and scientific standing, not merely to advise, but also to initiate and direct.

Agriculture in Santo Domingo.

The Dominican Republic, or, as it is more commonly known in the West Indies, San Domingo, has an area of nearly 20,000 square miles. The latest estimate of the population is only 700,000. The fertility of the land, which is mainly in its virgin condition, gives the possibility of immigration and future development. In fact from many of the smaller West Indian islands, especially the northern ones, there is a considerable emigration of labourers to work in that Republic.

One of the most important products of the Republic is sugar, produced mainly in the southern half, and it is probable, in view of possible future developments, that the entire southern part of the island will be devoted to this industry. The chief product of the northern part is cacao, much of it grown in the land around Samana Bay, while coffee is produced in the higher lands of the interior to a considerable extent. Tobacco is grown mainly in the central part, and is the third in value of the exports of the country. The grade of tobacco raised is good, although its quality could be much improved by more careful methods of cultivation and curing.

A large portion of the country is covered with forests. The wooded area is estimated at about 85 per cent. of the total land surface. The mahogany of these forests is well known for its excellent quality. Lignum-vitae is plentiful, especially in the south, while there are immense quantities of valuable dyewoods in the interior.

Government Control of Natural Indigo.

When the war broke out the dyers of Great Britain ceased to be able to obtain supplies of synthetic indigo, which was almost, if not quite, a German monopoly. It was then felt that there might be a danger of the supply of natural indigo falling into the hands of a very small group, which would not be for the interests of the dye industry in general. In order to ensure, as far as possible, an equitable distribution of the available supply of natural indigo, the British Government purchased practically the entire available stock, and allowed it to be gradually sold to the dyers at a reasonable price.

The amount purchased was 267 tons, at a cost of £351,000. Out of this the British Government were able to sell to the French Government, at their request, 100 tons. The remainder has been gradually disposed of to the trade, both for home consumption and for home export.

The Board of Trade Journal, January 31, 1918, says that the object of the Government in making this purchase was achieved, as at all times during the past three years the dyers have been able to obtain supplies of natural indigo at a fair market price. The entire amount has now been disposed of, showing a profit of £3,556.

How to Prepare Banana Meal.

The following directions and suggestions by Mr. Joseph de Verteuil, Acting Director of Agriculture, Trinidad, were published in the *Port-of-Spain Gazette*, February 7, 1918. They ought to be useful throughout the West Indies:—

Any kind of banana or plantain is suitable.

Cut the bunch when it is about three-quarters full or the fruit will ripen instead of drying.

Peel the bananas and slice thinly with a nickel or fruit knife, or one made from a thin piece of bamboo.

Do not use steel knives. Spread the sliced bananas thinly on wooden trays in the sun to dry. In fine weather they will dry in two or three days.

When dry, crush in an ordinary corn mill or pound in a mortar, and sift through fine muslin.

Banana meal is very digestible and nutritious. Good bread can be made by using it with equal parts of wheaten flour made in the same way as wheaten bread.

Banana meal cooked and eaten as oatmeal porridge is an excellent food.

In cake making the same proportions of banana meal can be used as in the making of bread.

Used in the form of milk pudding, it is prepared in the same way as rice pudding, and it is very palatable.

Make your Johnny cakes, and dumplings by mixing equal parts of wheaten flour with banana meal.

Dasheen, sweet potato, tannia, and yam meals can all be made in the same way as advised for banana meal, i.e., peeling, washing, slicing and milling the dried chips. Excellent bread, etc. can also be made from equal parts of wheaten flour, and any of the above meals.

INSECT NOTES.

QUASSIA EXTRACT AS A CONTACT INSECTICIDE.

An article under the above title appeared in the *Journal of Agricultural Research* for September 3, 1917 (Vol. X, No. 10) describing some experiments undertaken to find out the value of quassia extract as a general insecticide for all aphids, since this extract has been reported in literature as efficient against the hop aphis (*Phorodon humuli*, Schr.). The results of these experiments by Messrs. N. E. McIndoo and A. F. Sievers may be of interest, and are given in the following notes.

Official quassia is derived from either *Aeschrion* (*Picrasma*) *excelsa*, Swz. (family Simarubaceae), known commercially as Jamaica quassia, or from *Quassia amara*, L., a plant of the same family, known commercially as Surinam quassia. According to the literature on this subject there are several other plants which furnish wood with similar characteristics whose active constituent is identical with, or similar to quassiin, the bitter principle and main constituent of official quassia. These include *Simaruba amara*, Aubl., *S. versicolor*, St. Hil., *Aeschrion* (*Picrasma*) *quassioides*, Benn., and *Ailanthus excelsa*, Roxb.

The authors give a historical review of the literature dealing with quassia and quassiin, from which it seems that quassia has been used in different countries as a remedy for various internal disorders of man, and that from time to time numerous experiments have been made to find out the best way to extract quassia, and to determine its different constituents.

The literature on the use of quassia extract as an insecticide is also reviewed, from which it appears that quassia extract used in a spray solution with soap is effective against the hop aphis, but its action is slow.

The authors used a number of aphids and other insects in their experiments to determine the effectiveness of quassia extract as an insecticide. They tested the formula recommended against the hop aphis and found it efficient only on the nasturtium aphis (*Aphis rumicis*, L.), although it was tested upon six other species. This solution was composed of 6·3 grams of quassia chips soaked for twenty-four hours in 2,000 c.c. of water, to which fish-oil soap was subsequently added in the proportion of 1·6 lb. of soap to 100 United States gallons of water.

This mixture was also sprayed upon caterpillars of the fall web-worm (*Hyphantria cunea*, Dru.), and larvae of the potato beetle (*Leptinotarsa decemlineata*, Say.), but these were merely reduced to a state of stupor, from which they recovered the following day. Quassiin powder dusted on web-worms had the same effect on them, but caterpillars of *Bombyx mori*, L., the silk-worm, were killed.

The following summary of the remainder of the above article is reproduced from the *Review of Applied Entomology*, Vol. V, Ser. A, part 12. December 1917.

It gives the results of the experiments made by Messrs. McIndoo and Sievers to determine the best method for preparing quassia extract, and to find out the pharmacological effects of quassia extract, and quassiin on aphids. It also gives the conclusions of the authors that owing to the poor insecticidal properties of quassiin and its expense, quassia extract can never become a general insecticide for all aphids.

'Experimental tests for selection of effective formulae led to the conclusion that in making the extract a relatively long period of soaking is essential in order to get the maximum quantity of quassiin in solution; boiling the chips in water for four hours extracts 1½ times the amount obtained by soaking them in cold water for twenty-four hours; the smaller the chips and the finer the quassia powder used, the greater the quantity of extract obtained; the larger the quantity of water used as a solvent, the greater the quantity of extract; the addition of lye and soap to the water materially increases the effectiveness of the extract.

'As regards the pharmacological effects of quassiin, it was found that exhalations from quassiin powder killed aphids, but that those from quassia chips, quassia powder, and from solutions containing quassiin extract and quassia extract were ineffective. It was also shown that quassia extracts affected aphids only, and that quassiin extract does not act as a stomach poison upon bees (*Apis mellifica*) or *Rhagoletis pomonella*. Quassia powder dusted on insects had no effect, but quassiin powder killed them by affecting the nervous system. Quassia and quassiin spray solutions killed aphids, if used sufficiently strong, their effectiveness being increased by the addition of soap. While nicotine acts quickly and causes pronounced symptoms, quassiin acts very slowly and causes but few, feeble symptoms, the aphids slowly dying in a state resembling coma.

'It is concluded that, owing to the poor insecticidal properties of quassiin and its expense, quassia extract can never become a general insecticide for all aphids. A spray solution made by soaking 22 lb. of quassia chips in 100 U.S. gallons of fish-oil soap solution (1·6 lb. soap to 100 U.S. gallons water) for twenty-four hours, was efficient on only two out of six species of aphids tested, while the result was about equal to that obtained by using nicotine sulphate solution; the expense was nearly the same, while owing to its slower action it was much less reliable, as a shower of rain or the migration of the aphids nullifies its effects.'

ANTIGUA: REPORT ON THE AGRICULTURAL DEPARTMENT FOR THE YEAR ENDED MARCH 31, 1917.

During the year under review the Botanic Gardens were improved as to condition by a better drainage of a portion of them, and as to appearance by the substitution of a hedge of bread-and-cheese in place of one of Bougainvillaea which was not flourishing, as not suited to its situation, in the shallow soil of the spot.

A noticeable feature in the work of the nurseries during the year has been the large number of cane seedlings raised, no less than 4,111 having been grown from seeds of eight different parent canes. After field tests the majority of these will probably have to be discarded, but it is hoped that some will be found specially suited to local conditions, or suited to other cane-growing countries. One or two previously raised Antigua seedlings are regarded with approval in some districts in St. Kitts. The sending out of more than 8,000

sisal plants, sufficient for 11 acres in the windward district, seems to mark a laudable attempt at establishing a fibre industry in that drier part of the island. Most of these plants were obtained from older stations connected with the Department, where they had been established by former agricultural officers. In the list of plants distributed we also notice 3,196 eucalyptus trees, and 459 seedlings of *Prosopis juliflora*. This latter is known as the algaroba bean tree, and is a valuable shade tree in pastures: the seed pods are also readily eaten by cattle, and form a nutritious food. It appears that these trees will thrive well in Antigua, where they will doubtless benefit the pastures. The distribution of 1,565 coco-nut plants is an evidence that this cultivation is being extended in the island; in fact it appears that the local market for coco-nuts, which in the past depended on imports from Dominica, will soon be adequately supplied from recently planted groves. Many other plants and cuttings of economic value, together with a great number of seeds, were also sent out. The distribution of such large numbers of seeds and plants of valuable, and in most cases well tested varieties, must tend to the advantage of the various agricultural interests of the island. Among interesting plant importations of the year we notice *Carum copticum* or ajowan, a source of thymol, and *Passiflora edulis*, a hard-skinned, edible species of passion flower.

The plot experiments in connexion with minor products are carried out on a series of plots at Skerretts on Government land, less than a mile away from the Botanic Gardens, while varietal and manurial sugar-cane experiments are carried out in conjunction with the planters on estates in different parts of the island. The results of these sugar-cane experiments will be published separately.

Among the experiments at Skerretts there had been for many years a series in connexion with varieties of sweet potatoes. These experiments appear to have fulfilled their purpose as regards varieties already in cultivation, and they have therefore been discontinued. Experiments now, however, are being begun with seedlings raised from six well-known established varieties. One year's experiment is, of course, insufficient to establish reliable data as to the qualities of any of these new seedlings, still it would seem as if a few of them might give larger yields than any of the older varieties, and might be equal, or even superior in quality to most of them. The suitability of these new seedlings to various types of soil, or to differing moisture conditions will be well worth observing. Sweet potatoes form a very large part of the vegetable food of these islands, and improved yield and quality will be widely appreciated.

Another crop, with varieties of which experiments have been conducted for several years in Antigua, is cassava. Until recently not much of this was grown in Antigua. In the year reported on, however, there has been a considerable extension of the cultivation, as is shown by the fact that some 14,000 cuttings of the most approved varieties have been distributed from the Experiment Station. Cassava is so valuable flour for bread making, either as an adjunct to or as a substitute for wheat flour, that such extended cultivation is to be commended. It appears that cassava bread is being produced in Antigua, and is meeting with the approval of the public.

As might have been expected, the cultivation of other West Indian root crops used for human food—tannias, eddoes, and yams—has also been extended in the island since the threatened serious shortage of imported foods. The results of experiments with these roots, undertaken also for many years, must tend to give confidence in selecting the variety to be planted.

The onion crop of Antigua is now of some importance, 6,940 crates having being shipped from the island during the season reported on. Interesting experiments are being conducted on keeping onion seed over from one season to allow of early planting, so as to enable the produce to be put on the American market before the Bermuda crop comes in. A full account of these experiments appeared in the *Agricultural News*, April 7, 1917.

Trials in raising crops of Ruta Baga (Sweedish turnip) and Mangel Wurzel, as food for hogs, were fairly successful. It would seem that the latter especially might be cultivated profitably in the island.

With regard to progress in the chief industries, the total sugar crop for the season was 18,542 tons, namely 14,929 tons of crystals and 3,613 tons of muscovado. This is probably a record crop for the island, and is due not only to the favourable weather during the growing season, but also to the fact that so much of the crop is manufactured by the two factories, thus securing a much larger percentage of sugar from the canes reaped. As a result of the high prices obtaining for sugar there has been a considerable increase in the area put under sugar-cane, especially by peasant growers. We notice that the most popular varieties of cane in Antigua are said to be six of the Barbados seedlings—one of them being the Sealy Seedling—and the White Transparent. It also appears that the Uba cane from South Africa, introduced some years ago, is becoming increasingly popular on some of the heavy lands. The value of this cane is, that although its sucrose content is low, it produces fairly heavy crops on poor soils, and is capable apparently of standing protracted dry weather.

With regard to the cotton industry a decrease in acreage is reported. This was attributed to the high prices for sugar, causing many planters to grow more cane and less cotton. The selection of cotton is being continued in order to fix a reliable type suitable to the local conditions

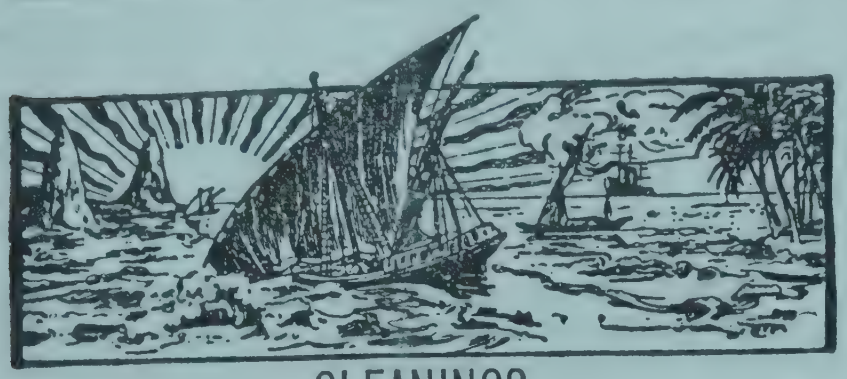
A very pleasing feature in the report is the evidence afforded of an increasing spirit of co-operation, not only among those connected with any one particular industry, but all interested in the welfare of the island. Thus the Onion Growers' Association has been followed by the Cotton Growers' Association, and the Lime Growers' Association, and now representatives of these associations, together with representatives of the Agricultural and Commercial Society, are formed into a Central Board for Co-operative Organizations. The object of this board is to facilitate the spread of co-operative enterprise in Antigua. It is to be hoped that its efforts will be crowned with success, and that co-operation may be adopted in yet other directions. Some of these directions are noted in the report here reviewed. Further particulars on this subject will be found on another page of this issue.

The report contains reviews of the work for the year of the associations mentioned above, which are full of interesting matter, and also reference to the proceedings of the Antigua Agricultural and Commercial Society.

There are also appended Rules made by the Governor-in-Council for the sale of Crown Lands in Antigua, which appear to be wisely conceived. These especially apply to Sawcolts estate which has been set apart for a Land Settlement.

In connexion with the Land Settlement scheme, the work of agricultural instruction undertaken by officers of the Department will undoubtedly have a good effect.

The report is an interesting one, and shows that good work is being done in many directions by the Agricultural Department of Antigua.



GLEANINGS.

According to preliminary estimates, the sugar crop of Cuba this year should yield 3,462,000 tons, as against 3,019,900 tons in the year preceding. The harvesting of the crop, however, may be difficult owing to a scarcity of labour. (The *Financier and Bullionist*, January 23, 1918.)

Poultry of all ages are fond of turning over manure as it leaves the stable in order to find larvae and remnants of food occurring between the layers of litter; the voracity with which poultry destroy the larvae is a very important factor in rural hygiene. (*International Review of the Science and Practice of Agriculture*, October 1917.)

In Trinidad the Department of Agriculture states that from a plot 100 feet by 25 feet, there should be obtained in a year, with good cultivation, 500 lb. of yams, 250 lb. of sweet potatoes, 80 lb. of tannias, 180 lb. of cassava, 80 lb. of corn, as well as some miscellaneous vegetables such as tomatoes and cabbage. (The *Colonial Journal*, January 1918.)

An advertisement in the *Port-of-Spain Gazette*, February 7, 1918, seems to show that Trinidad is able to stand a shortage of imported butter. A coco-nut butter substitute is advertized as having stood the test of the prejudice against local products, shown by the fact that within the previous six months over 10,000 lb. have been supplied to dealers both in town and country.

According to the *Veterinary Record*, January 12, 1918, an Italian veterinary surgeon has employed sugar in the treatment of numerous lesions, and has reached the conclusion that on account of its absorbent, antiseptic, and cicatrizing properties, sugar represents a therapeutic agent of the first order, which may render great service in veterinary surgery, especially in private practice, as a substitute for the common antiseptic powders.

Considerable attention is now being given to cotton production in South Africa, and 30 tons of cotton have recently been shipped to the United Kingdom. The success of cotton cultivation depends largely on the use of by-products, especially the seed. The Imperial Institute has examined a sample of cotton seed from South Africa which was found to be of good quality, containing about 20 per cent. of oil. (*The Board of Trade Journal*, January 24, 1918.)

The market for the essential oils produced in the West Indies continues steady at high and remunerative prices. According to the market report in the *Perfumery and Essential Oil Record*, January 1918, bay oil is in good request, and the price is maintained at from 13*s.* to 14*s.* per lb. West Indian lime oil is quoted at 8*s.* to 8*s.* 6*d.* for distilled, and at 20*s.* to 21*s.* for hand-pressed. Jamaica orange oil is quoted at 8*s.* to 8*s.* 6*d.* per lb.

It cannot be too strongly urged that all liquid manure should be saved and applied to the land, if for no other reason than because of its richness in potash. Hendrick has shown that 1,000 gallons of liquid manure contain nearly 50 lb. of potash, equivalent to that present in 3 cwt. of kainit. In addition, there is about 20 lb. of nitrogen, equivalent to that present in 100 lb. of sulphate of ammonia, and also there is a little phosphoric acid. (The *Journal of the Board of Agriculture*, December 1917.)

Attempts to acclimatize the camphor tree have extended in different parts of the world over a good many years. In America particular attention has been given to planting *Cinnamomum Camphora* in Florida, where extensive plantations already exist, and others are in process of formation. In America all the real attempts to obtain camphor appear to have been directed to the leaves and young twigs, the distillation of the wood having apparently been found to be unsuitable to the locality. (The *Perfumery and Essential Oil Record*, January 22, 1918.)

The carambola (*Averrhoa Carambola*), belonging to the family Oxalidaceae, produces an ovate fruit from 2 to 5 inches long, with five prominent acutely angled ribs. The skin is very thin, light yellow in colour when ripe, and the flesh is watery and crisp. There are two distinct varieties, the sweet which is eaten fresh, and the sour which is very acid and is used for pickles. An excellent drink is also made from the mature fruit in much the same manner as lemonade is prepared. This species must not be confused with *Averrhoa Bilimbi*, which has smooth, green, cucumber-shaped fruits, which make excellent pickles, but are far too acid to be eaten raw. (The *Hawaiian Forester and Agriculturist*, October 1917.)

The cultivation of Ipecacuanha (*Psychotria ipecacuanha*) is being experimented with at the Kuala Lumpur Experimental Plantation in Malaya. Propagation is by root, stem, and seed. The permanent distance of planting is 18 inches. Ipecacuanha must have shade throughout its period of growth. The plants are ready for lifting when two and a half years old, and yield from 2 to 3 oz. of marketable root per plant. The roots require to be carefully lifted, thoroughly washed, sun-dried, and all foreign matter removed before being sold. Ipecacuanha can be grown as a catch crop under moderate shade. The present value of the root is about 8*s.* per lb. (The *Agricultural Bulletin of the Federated Malay States*, August and September 1917.)

The *Colonial Journal* for January 1918 states that His Majesty's Government have recently appointed a committee to investigate the best means of developing the growing of cotton within the Empire, and to advise the Government as to the necessary measures to be taken for this purpose. The committee have prepared a statement of the points on which they desire information from various parts of the Empire, and the Secretary of State has asked the Colonial Governments, which are or might be concerned, for their observations. The first question put relates to the area of suitable land which could be made available, under three heads: (1) without public expenditure; (2) with moderate expenditure on roads, etc.; (3) with extensive programme on railways, etc. Other points are the supply of labour, and the best method of development.

THE PINE-APPLE GUAVA.

The true guavas (Psidium) are widely known and enjoyed throughout tropical and subtropical regions, both as fresh fruit and in the form of jam, jellies, marmalade, etc. Closely related to them, however, is a little-known species, the pine-apple guava (*Feijoa Sellowiana*)—correctly pronounced fay-zhó-a.

This species is native to subtropical South America, particularly Western Paraguay, Southern Brazil, Uruguay, and parts of Argentina. In these countries it is common in the forests. Although not cultivated by the natives, the fruit is highly prized by them. The designation pine-apple guava refers to the flavour of the fruit, which strongly resembles that of the pine-apple. It is called Brazilian guava or fig guava. The genus is closely allied to Psidium, but distinguished from it by albuminous seeds and stamens suberect in the bud. The only general account in American literature of this species is that of F. W. Popenoe, in the *Pomona College Journal of Economic Botany*, 2 (1912), No. 1, pp. 217-42, but this journal had a limited circulation and has been defunct for several years. The fruit was unknown in the Hawaiian Islands previous to 1908, and the following account, taken from the *Hawaiian Forester and Agriculturist* for December 1917, is the first to emphasize its possibilities in this territory of the United States.

The pine-apple guava was introduced into Southern Europe in 1890, and is grown in Southern France and Italy. From Italy it was introduced into the United States in 1900. It has been widely planted in California; in 1908 the Hawaiian Agricultural Experiment Station received plants from Southern California, and these have grown satisfactorily. The tree itself is well adapted for use as an ornamental and as a hedge-plant; the fruit is of unusual horticultural promise. There are now in the market several named varieties, of which André, Hehre, and Besson are the best known.

The shrub attains a height of 10 to 15 feet. Very old plants may have a total spread of 18 feet or more, the trunks 8 to 10 inches thick at the base. The branches are rounded and swollen at the nodes. The bark is light gray, the entire plant, with the exception of the upper surfaces of the leaves and the corollas, is covered with white tomentum, the leaves are opposite, short petioled, thick and coriaceous. They resemble those of the olive, but are much larger. The upper surface is dark glossy green; the lower surface is silver gray, canescent, and finely pubescent. The striking contrast in the two surfaces constitute one of the ornamental features of the plant. The margins are slightly recurved. The veins are inconspicuous on the upper surface of the blade; below they are fine, prominent, and in arcuate reticulations, re-uniting before reaching the margin of the leaf.

The flower buds are globular, puberulent, and constricted above the ovary. The flowers are showy (1 to 1·5 inches in diameter) red, white and purple, bisexual, and solitary or in clusters. They appear in late spring. The pedicles are one-flowered at the ends of the branches or becoming lateral. They are at first straight, then recurved, ·50 to ·75 inch long, whitish and velvety. The calex tube is turbinate. The sepals are 4, unequal, obtusely elliptical, recurved; pubescent, and ciliated. The petals are 4, spreading, thick and fleshy, ovate or obovate, entire or emarginate, obtuse, glabrous and ciliated. They are cupped, white on the outside, and purplish crimson within. After anthesis they become recurved; they have a sweet flavour.

The stamens are numerous, perigynous, erect in a large cluster of many series, about 1 inch long. The filaments are showy, filiform, deep purple or crimson red. The anthers are globular and yellow. The style is longer than the stamens, filiform, and with a capitate stigma. The ovary is 4-celled, oblong, turbinate. The flower as a whole is very attractive, with plentiful nectar, pollen and aroma; a bush in full blossom is handsome to a marked degree.

It has been demonstrated that the flowers of the pine-apple guava are largely self-sterile, and although isolated plants are not infrequently productive, it is good horticultural practice to plant two or more bushes together so as to permit cross-pollination.

The fruit is a berry, oblong or oval, 2 inches long and 1·5 inches in diameter (there is considerable variation in size), with 4 many-seeded locules. When mature it is characterized by a delicious penetrating odour. The surface is at first tomentose, then smooth. The fruit is crowned by the thick disc and cupped sepals of the persistent calex. The skin is much indented, slightly and unequally furrowed, but upon maturity becomes smooth. In colour it is dull green, sometimes flushed with crimson on one side. The green colour is retained at maturity. The flesh comprises a firm, whitish, granular layer, which surrounds the central pulp. The pulp is thick, creamy yellow or translucent, and melting. It possesses a delicious flavour, strongly resembling that of the fully natured pine-apple, with a rich heavy bland perfume. In the pulp are twenty to thirty very small oblong seeds, so small as to be unnoticed in eating the fruit, and contrasting with the seedy interior of the common guava.

The fruit should not be picked until it is fully mature. It ripens in autumn and early winter, and falls to the ground upon maturity. The ripe fruit should be laid in a cool place until ready for eating. Little care is required in packing; the fruit is an excellent shipper if it is kept cool. It quickly spoils in a hot, humid atmosphere, but can be kept for a month or more if suitable conditions are maintained. It is not only delicious when eaten out of hand, but can also be cooked, crystallized, and made into jams or jellies.

A notable feature of the pine-apple guava is that it grows better under subtropical conditions than in strictly tropical regions. The best climate for it seems to be one free from excessive moisture and cool for at least a portion of the year. The plant is notably drought resistant, and contrasts strongly in this respect with many other tropical fruits. It requires very little pruning or other attention, and is said to be hardier than most of the fruits found in the Hawaiian Islands, such as the mango, and the avocado pear.

Propagation is usually by seed, which comes fairly true. The seedlings come into bearing in three to five years. Cuttings of the young wood are successfully rooted under glass; the layers root in about six months.

The pine-apple guava offers very attractive possibilities to all who are interested in tropical and subtropical horticulture. A note referring to the introduction of this plant into England, and also into the Botanic Gardens, Dominica, in 1912, appeared in the *Agricultural News*, Vol. XVI, p. 411.

PLANT DISEASES.

PLANT DISEASES IN BARBADOS IN 1916-17.

The following account of observations made by Mr. J. S. Dash, Assistant Superintendent in the Barbados Department of Agriculture, is contained in the Annual Report of that Department, issued as a Supplement to the *Official Gazette* of January 24, 1918.

SUGAR-CANE.—During the year the root fungus, *Marasmius Sacchari* was by far the most troublesome disease, particularly in young ratoon canes. Many instances of this came under notice, especially in districts where very long ratooning is practised. In the black soils, plant canes in some fields also suffered from the disease. It is often thought that this fungus is only a product of dry weather. As a matter of fact any unfavourable environment will induce it. In very wet seasons such as have been experienced in the last two or three years, the disease frequently makes its presence felt in heavy fields which have not been sufficiently drained. The yields of cane from such fields are often considerably reduced and planters are unable to explain the cause satisfactorily, yet an examination of some of these apparently good fields during November and December will reveal the presence of many holes with few canes, and these thin and poorly developed. It is not necessary for the leaf-sheaths to be all matted together for the disease to be detected: at this stage there may be hardly any cane to reap at all. Good drainage, proper tillage, and the use of healthy plants, in other words, conditions which keep up the vitality of the plant, make the losses from root disease very small in most seasons.

Colletotrichum falcatum, the fungus causing red rot-has been noticed in one or two isolated instances.

Thielaviopsis paradoxa, the fungus causing pine-apple disease, continues to be a very troublesome disease of cane cuttings. The necessity of using good material for planting and thoroughly disinfecting the cuttings with properly made Bordeaux has been dwelt on over and over again in these reports.

The leaf-sheath red spot fungus, *Cercospora vaginae*, has been fairly common during the season.

The fungus *Cephalosporium sacchari*, which was discovered during the previous season attacking sugar-cane, and with which much work was done last year (Report 1915-16), has not appeared this year to any extent at the estate on which most of the attack was noticed in 1915-16. It will be remembered that the disease was noticeable only on canes whose growth had been interfered with in some way, being most apparent on the outer rows of certain fields, which had suffered somewhat from the effects of a strong southerly gale. A few examples of cane possessing this fungus have been sent to the laboratory during the season from different places, and isolated specimens have been observed in several cane fields. In most of these cases Cephalosporium had followed an attack of *Marasmius sacchari*, or had gained an entrance through a borer hole.

MISCELLANEOUS.—The writer knows of no instance where cotton suffered much from any particular disease. Mildew and leaf spots are always present in most cotton fields, and there has been no report or observation that these were more prevalent than usual during the season.

Tobacco is grown by one or two persons locally. During the season two diseases have come to the attention of the writer. One appears to be a bacterial disease causing a wilt of old plants by attacking them just above ground, a cankered area from which there is much exudate being formed, which gradually extends up the stem. The other is caused by a fungus, a species of Fusarium, which has been found attacking the roots of young plants and in many cases the bases of the plants. The injury causes the young plants to wither and finally die. The damping off fungi, *Pythium* sp. and *Rhizoctonia* sp., were not present in this case. The recommendations made for dealing with the former disease were first, to pull up all plants showing the affection and to burn them; then, if the trouble persisted, to grow some crop other than tobacco on the soil for a few years. For the second disease, the destruction of all dying plants was advocated, this to be followed by a liberal application of lime to the soil, which should be given a rest for several months.

THE CONTROL OF CACAO CANKER IN JAVA.

In a recent communication (*Mededeelingen van het Laboratorium voor Plantenziekten*, No. 30), Dr. C. J. J. van Hall reports the very striking success obtained on a certain cacao plantation in Java by the adoption of a revised method of general treatment for cacao canker.

It must be borne in mind in considering the following account that whereas in the West Indies, in Ceylon, and in other cacao-growing areas the canker fungus, *Phytophthora faberi*, is also responsible for heavy losses sustained from the black rot of pods, and the passage of the fungus from pod to cushion is held to be a fruitful source of canker infection, mycologists in Java, while confirming the common origin of the two diseases, consistently report that pod rot, even on estates badly infested with canker, causes but a very small percentage of loss in that country.

The cacao on the estate concerned in Dr. van Hall's report is of the susceptible Criollo type, and the trees originally numbered some 18,500 on about 90 acres of land. They were planted in 1901, and canker began to take effect about seven years later. In the following four years, i.e. up to the beginning of 1913, some 4,644 trees, no less than 25 per cent. of the stand, succumbed to the disease. The treatment applied during this period was adopted from Ceylon practice, and consisted in deep excision of the canker spots until the discoloration was all removed, and covering the wound with a mixture of carbolineum and black tar.

The failure of this treatment, as demonstrated by the death of about 1,000 trees in 1912, led to a reconsideration of methods, and the following measures were tested and recommended: (a) thorough pruning, in order to reduce the heavy canopy previously maintained, and thus to admit more light and air; (b) the mere shaving of the surface of the affected bark as opposed to its complete excision, the idea being that in consequence of the close dependence of the fungus on moisture, the exposure of the affected tissues would dry them out sufficiently to make them untenable by the parasite; the treatment with tar was discontinued on the grounds that it prevented effective supervision of the work done, that it hindered the recognition of recovery or relapse, and that the tarred layer prevented the drying out desired; (c) the more careful control of boring beetles, the tunnels of which afford openings for infection.

It was desired to add spraying of the trees with Bordeaux mixture to these measures, but the difficulties encountered, especially that of the provision of water, were so great that a decision was reached to test the effect of the rest of the treatment without the spraying.

The results, as set out in the following table, speak for themselves:—

NUMBER OF TREES ATTACKED BY CANKER.

	1913.	1914.	1915	1916.
No. of trees on estate	16,296	15,845	15,549	15,438
January	870	98	29	11
February	943	125	24	9
March	836	103	35	29
April	552	81	55	16
May	566	137	31	10
June	185	63	19	
July	141	44	20	
August	53	44	16	
September	41	50	21	
October	78	54	19	
November	48	44	21	
December	87	40	23	

After May 1916 further reports were not received. The first quarter of the year, in which as will be seen the number of attacks is greatest, is the season of highest rainfall. It will facilitate comparisons with West Indian conditions to give an abridged table of the rainfall for the period covered.

	1913.		1914.		1915.		1916.	
	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.
Jan.-Mar.	39.16	61	35·38	47	49·84	50	62·88	61
Apr.-June	21·51	30	8·82	23	19·20	27		
July-Sept.	0·59	2	0·07	7	8·86	10		
Oct.-Dec.	16·94	23	22·93	32	18·0	38		
Total	78·20		67·20		96·00			

The returns of the number of the trees annually lost shows a steady decrease, though this is rendered less marked by the death of trees so badly damaged in previous years that they could not possibly recover. The average annual loss from 1908-12 was 929 or 5·4 per cent.; in 1913 it was 447 or 2·8 per cent.; in 1914 it was 396 or 1·9 per cent.; and in 1915 it was 111 or 0·7 per cent.

As is well known, Criollo cacao, in spite of its superior quality, has been practically abandoned in the West Indies owing mainly to its susceptibility to diseases, of which canker is the most important. It seems highly probable that with careful attention to control measures, including periodic spraying with Bordeaux mixture, it could now be maintained in fair health. Whether the higher quality could be made to pay for the extra care needed is a question worth attention from the planter. The growing competition of African cacao would seem to render reduction of prices for the common kind inevitable. A sound policy for a well-organized industry to adopt in competition with cheaper but less well-organized production lies in the improvement of quality. It remains to be seen whether the West Indian producers are able to justify their inclusion in the former class.

W.N.

SANDALWOOD.

Sandalwood oil is one of the most expensive essential oils employed in the manufacture of perfumes. The source of the genuine article is the heart-wood of the trunk and of the larger roots of *Santalum album*, a small evergreen tree indigenous in Southern India, more particularly in the dry hilly districts of Mysore, from which it is estimated nearly three-quarters of the world's supply of true sandalwood is derived.

According to the *Bulletin of the Imperial Institute*, Vol. XV, No. 1, before the outbreak of the war about 52 per cent. of the export of the wood from India went to Germany for distillation, and only from 10 to 20 per cent. to the United Kingdom, another 12 per cent. going to the United States.

The closing of the German market at the outbreak of the war led to something like a collapse for the time being of the sandalwood industry in Mysore. The Government however started the distillation of the oil in Mysore, as a government monopoly. This as carried on with modern appliances is practically a new industry in India. The first factory erected, capable of producing 2,000 lb. of oil per month, was so successful that it was enlarged to a capacity of 5,000 lb. per month. A second factory erected in Mysore will probably ultimately have an output of about 20,000 lb. of oil per month, sufficient to supply the whole of the European demand for sandalwood oil. It is likely that all the sandalwood from the South Indian forests will ultimately be dealt with at this factory.

Besides the true sandalwood oil there are certain substitutes put on the market, the most common being oil obtained from *Amyris balsamifera*, a plant indigenous in Venezuela and many of the West Indian islands.

Besides the demand for the oil, there is a large market for sandalwood in Eastern countries, particularly in India and China for ceremonial uses, and for carving. Its use in religious rites, especially for cremation, can be traced to very early times. The word sandal is in fact a Sanscrit word meaning 'the tree'. Real sandalwood therefore fetches a high price in China. Owing to this there is an importation of substitutes for the wood chiefly from Australia.

The so-called sandalwood exported from Australia is mainly derived from *Fusanus spicatus*, a tree of Western Australia, the value of the export of this wood in 1915 being estimated at £83,556. In addition, there is a small export from other states of the Commonwealth, of *F. accuminatus*, known locally as 'quandong'.

It would seem as if European distillers will be obliged to seek other sources of supply of true sandalwood, and no doubt efforts will be made to cultivate *Santalum album* in other tropical countries.

Already the wood is being exported from Celebes. It is said also to be cultivated in Java, and to some extent in Mauritius. Possibly it might be cultivated with success in some of the drier islands of the West Indies. Owing to the semi-parasitic habits of the tree there may be some difficulty in providing suitable hosts in new localities. In India some 144 different trees have been recorded as serving as hosts of the sandalwood. *Santalum album* is a tree of slow growth, requiring from twenty to forty years to develop the maximum amount of fragrant wood. It is therefore necessary to select as hosts species of trees that have themselves a life of at least forty years, and trees of the leguminous family are suggested as being the most suitable for the purpose. Many of these trees, however, are well known in the West Indies, and grow well, such as *Pithecolobium Saman* and *Albizzia Lebbek*. As regards hosts therefore, it would seem as if these West Indian islands were well provided with them. In the matter of soil, Dr. C. A. Barber, in a paper contributed to the *Memoirs of the Department of Agriculture, India*, Botanical Series, Vol. I, No. 1, states that although the trees grow and flourish in rich soil, those grown on poor rocky soils in the Mysore hills produce wood which yields a much higher percentage of oil.

MARKET REPORTS.

London.—The West India Committee Circular, January 24.

Arrowroot—6¼*d.* to 7*d.*
Balata—Venezuelan Block, no quotations; Sheet, no quotations.
Beeswax—No quotations.
Cacao—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
Coffee—Jamaica, 79/- to 160/6.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, 87/- to 115/- per cwt.
Honey—Jamaica, 148/- to 155/- per cwt.
Lime Juice—Raw, 2/- to 3/.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—1/6 to 3/6.
Pimento—4¼*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., January 29.

Cacao—Venezuelan, $13·00 to $13·75 Trinidad, $12·00 to $13·00.
Coco-nut Oil—$1·36 per gallon.
Coffee—Venezuelan, 12c. per lb.
Copra—$7·75 per 100 lb.
Dhal—$14·25 to $14·40.
Onions—$8·00 per 100 lb.
Peas, Split—$12·00 to $12·50 per bag.
Potatoes—English, $3·85 per 100 lb.
Rice—Yellow, $11·50 to $11·75; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., January 15.

Cacao—Caracas, 12¾c.; Grenada, no quotations; Trinidad, 13½c. to 13¾c.; Jamaica, 9c. to 10¼c.
Coco-nuts—Jamaica selects, $38·00 to $40·00; Trinidad selects, $36·00 to $38·00; culls, $18·00 to $20·00 per M.
Coffee—Jamaica, 9¼c. to 11c. per lb.
Ginger—16½c. to 20c. per lb.
Goat Skins—Jamaica, 85c.; Antigua and Barbados, 75c. to $85c.; St. Thomas and St. Kitts, 70c. to 75c. per lb.
Grape Fruit—Jamaica, $2·00 to $2·50 per box.
Limes—$6·50 to $8·00 per brl.
Mace—31c. to 37c. per lb.
Nutmegs—18c. to 21c.
Oranges—$1·75 to $3·50.
Pimento—6c. per lb.
Sugar—Centrifugals, 96°, 6·05c; Muscovados, 89°, 5·05c. Molasses, 89°, 4·85c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., March 4.

Arrowroot—$10·00 per 100 lb.
Cacao—$12·50 per 100 lb.
Coco-nuts—$24·60 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $4.75.

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Botanic Gardens.

THERE is perhaps a tendency in the speech and thoughts of most people to confuse botanic gardens and experiment stations, and to consider the terms as more or less synonymous. In reality the origin and functions of the two institutions are very different.

In the first place, botanic gardens are much the older of the two. They can be directly traced back to the gardens attached to the monasteries of Europe, where medicinal herbs as well as nutritious vegetables were cultivated, and their properties studied. Perhaps one may not be far wrong in tracing the origin of modern botanic gardens to the dawn of history, for we find not only in Hebrew traditions, but in early records of Egypt, Assyria, and China that gardens wherein was 'every tree that is pleasant to the sight and good for food' were desirable possessions of the race. For instance, as Mr. Hill the Assistant Director of the Royal Botanic Gardens, Kew, points out in an address delivered at the twenty fifth anniversary of the Missouri Botanical Garden, the earliest garden of which we have any representation is that, of Thothmes III in Egypt about the year B.C. 1,000 which was planned by the head gardener of the gardens attached to the temple of Karnak. Perhaps, however, the Chinese rather than the Egyptians are to be credited with having first had the idea of a real botanic garden, seeing that it is clear that several of their early rulers despatched collectors to distant countries to bring back plants which were cultivated for their economic or medicinal value. From a list of plants thus introduced by the Emperor Wu Ti in the second century B.C., the banana and the sweet orange have been identified along with many others by modern scholars.

Coming to a more recent period of history we have an exact contemporary description of a monastic garden of the ninth century with its attendant 'Physic Garden,' which was the direct origin of the gardens established in connexion with the medical faculties of the Italian universities of later centuries.

As the monks were bound to live for the most part on pulse, vegetables, and fruit, the cultivation of the monastery garden was of the greatest importance to them. It is difficult to speak too highly of the debt which botanical science owes to the care the monks of the middle ages took of their gardens, and to their knowledge of drugs and plants.

Then came the Renaissance with its great revival and widespread interest in science of every kind, not least in that of botany. With a real growth in the knowledge of plants and their uses, there grew up also a great number of ridiculous or superstitious beliefs about plants, which accurate investigation and experiment have entirely dispelled. Then were founded the physic gardens attached to the medical faculties of the universities, one of which, at Padua, founded in 1545, still exists in very nearly its original plan in the same place. These physic gardens gave students of medicine an opportunity of studying the plants from which they compounded their drugs, and were also a source from which they might obtain such plants in their future practice.

Very soon after the founding of the gardens at Padua there were introduced into them plants other than those of merely medicinal value. This was doubtless due to the rivival of interest in plants themselves, and the desire for collecting them from other lands, which seem to have been awakened in the middle of the sixteenth century by the then recent geographical discoveries.

From this time onwards there appears to have been a kind of rivalry between the various gardens as to which could grow the greatest number of plants collected from all parts of the world. Along with the interest aroused in the collection and cultivation of all kinds of plants, there was also displayed great interest in the description and illustration of them. Not to speak of many such herbals published on the Continent, there are the famous ones of Gerard, and Tradescant, and Parkinson in England, the authors of which must not only have been most successful gardeners, but must also have been very patient and exact observers.

Thus we come to the foundation in the seventeenth century of gardens by private or municipal benefactions for the purpose of allowing the public to observe and study plant life. This leads us to the establishment of the greatest of all botanic gardens, the Royal Botanic Garden at Kew, in the eighteenth century, and its like in many cities of Europe, and their descendants or copies all over the civilised world.

The first botanical garden in the tropics seems to have been that of the island of St. Vincent founded by the British Government in 1764. But the magnificent gardens at Buitenzorg in Java, at Calcutta, and at Peradeniya in Ceylon, together with that at Rio de Janeiro are striking examples of the benefits such gardens confer upon the countries in which they are situated, by the introduction of new crops, such as cinchona in India and rubber in Ceylon.

We have seen that botanic gardens, in their origin, were based on utility. This is perhaps the best distinction that can be made between their function and that of the public garden or park, where plants are grown primarily for purposes of ornament or shade. The essential difference is apt to become blurred, especially in the case of botanic gardens situated near to towns, and needs to be re-emphasized from time to time. There is no reason why botanic gardens cannot or should not be ornamental, but this should be strictly subsidiary to their main purpose.

What then are the proper functions of a botanic garden, large or small, in the neighbourhood of a great city, or in a small tropical island? First there is the scientific function. New plants are introduced from other climates and other lands, and these are grown and studied so as to discover whether they are capable of adaptation to their new surroundings, and whether they are likely to be of value, economic or æsthetic.

Second only perhaps to plant introduction should be the maintenance, so far as it is possible, of a representative collection of the more interesting and useful plants of the surrounding country, and especially of species allied to those in cultivation. The latter are of great interest to the taxonomist, to the plant breeder, and to the pathologist, because of the likenesses and differences they exhibit in comparison with the species grown for use. In a cotton-growing island, for example, nothing could be more appropriate or more useful, so far as botanic gardens go, than a representative collection of the native cottons, many types of which are in process of extermination owing to increasing strictness regarding close seasons. With them, it is quite conceivable, may be lost characters or qualities which would some day prove highly valuable.

Again, botanic gardens afford botanical students opportunity for research in plant biology and pathology. One can hardly place a limit to the benefits that agriculture and horticulture have derived and may derive from researches in this direction. Our modern science of genetics, for instance, is derived from the studies of Mendel in a monastery garden in the last century. By work on the lines indicated by his discovery, races of useful plants are being multiplied and modified so as to be more exactly suited to the variable conditions in which economic plants are grown, and

to produce far greater crops than their ancestors. Studies which lead to such results can best be carried on in botanic gardens, where there ought to be found a greater amount of material and more scientific appliances than are possible in most private establishments.

Besides the scientific function of botanic gardens there is their educational aspect. In an article on this subject in *Science*, June 29, 1917, it is well remarked that the notion that knowledge can be acquired from books is too prevalent: the idea that one can read *about* nature, and thus acquire knowledge *of* nature is as misleading as to suppose that one can acquire knowledge of buisness by reading about business. We must distinguish between information and knowledge. Information may be obtained by reading, but knowledge can only be acquired by contact with and experience of realities. Hence botanic gardens open to the public a source of real knowledge of plants; and there is no more pressing problem to-day than to learn how to grow plants, and how to grow them in increasing quantities and of increased value in every possible situation. If made without insight into plant nature, efforts in this direction pass through a period in which knowledge is acquired through painful experience, very often with failure as the ultimate result.

THE ORIGIN OF THE UBA CANE.

The Uba or Yuba cane is best known as the only variety of sugar-cane grown to any large extent in Natal, where, 'although it is not altogether a satisfactory type from a milling point of view, it meets with great favour by the planters, and is the only one which has hitherto stood successfully the ravages of frost and drought, as well as the various fungoid and animal pests met with in the sub-tropical areas of that province.'

The variety has several times been introduced into the West Indies, and though it is hopelessly inferior to the West Indian types, it has been found capable of useful application in Trinidad and Antigua on soils physically unsuitable for ordinary cane.

The most likely theory regarding the origin of this cane is that it was brought to Natal by a former Governor when returning from a voyage to India in 1884-5. Dr. C. A. Barber contributes a note on this point to the *International Sugar Journal* for January 1918. Having grown Uba cane from Natal for a considerable number of years alongside Indian varieties, Dr. Barber feels no doubt whatever that it is a *Ganna* cane of the *Pansahi* group of Indian cane, a series which is grown in many places from Assam to the Punjab, a distance of over 1,200 miles along the Himalayas. The Ganna canes as a class are intermediate between the thick tropical canes and the slender indigenous Indians one. The idea that the Uba is an Indian cane is therefore definitely confirmed.

Dr. Barber has met with a difficulty in the name. No word bearing any likely relation to uba has been found in any Indian language. But a recent visit to Burma has supplied a possible explanation. Noticing a Moulmein cane that was indistinguishable from Uba the question was asked if there was any Burmese word of that sound. The reply was 'Oh, yes, of course, "u-ba" means "take it"'. It is the usual reply of the polite Burman (who will give you anything) to any request made on going round his fields. So that the suggestion follows that the Natal Governor, leaving from a Burmese port, as was likely at that time, asked for specimens of this cane, and mistook the inevitable reply for its name.

Dr. Barber further remarks that he has often wondered at its being grown in Natal and Queensland. It is true that it is very resistant to salt in the soil, moderately fibrous, very luxuriant, and tillers well. It requires little water, and is much easier to grow on poor land than thicker canes. On the other hand, it has a low sucrose content, and is subject to red rot. It is not reckoned at all as among the best Indian varieties. The Madras cane-breeding station has raised a number of thin canes which possess the hardy qualities of the group combined with a good sucrose content, and plants of these are offered to the Natal growers for trial, with a good prospect of their being found superior to the present stock.

HUMUS CONTENT OF THE SOIL, AND FERTILITY.

Experiments conducted at Purdue University using a surface clay soil very deficient in organic matter and different organic manures, undertaken to prove whether the humus content of the soil is a guide to fertility, are reported in *Soil Science*, 3 (1917).

The results of the vegetation and humification tests seem to show that wherever there is rapid humification of manure, the growth of the plant is greatly stimulated, indicating 'that the decay of organic matter is desirable in plant growth and not just its mere presence.' This was especially noticeable when green manures were rolled under and limed, as compared with discing or mixing the manures uniformly with the soil.

Certain of the manures seemed to be as soluble in a 4-per cent. ammonia solution when just mixed with the soil as after humification. This was found to be true with alfalfa and steer and somewhat with cow manures. Horse manure seemed to humify slowly, and its plant food was largely unavailable to corn during the first year, but the humification and vegetation tests showed it becomes more available in the second year. It was possible to increase the rate of humification of horse manure in the first year by adding dolomitic limestone, which resulted in a greater yield of corn than where humification had not taken place.

The organic residues left in the soil from manure treatment were not very effective during the second year in producing a growth of corn, probably because the most available or valuable complexes had disappeared in the first year. There is no apparent relationship between the percentage of ash in humus and the growth of corn. The humification and vegetation tests seemed to indicate a rather close relationship between the amount of humus and the growth of corn.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. The Superintendent of Agriculture writes to say that during the month of January and February the picking of the cacao crop was continued with good results. The spice crop prospects for the next four months are very satisfactory. The sugar crop which had been started will, Mr. Moore estimates, be smaller than usual. A native food crops campaign for 1918 has been started, and a corn drying and storing scheme submitted by the Superintendent to the Government. The month of February was windy up to the 18th, but calm and very rainy during the last week. A somewhat severe shock of earthquake, of about 40 seconds duration, was experienced at 7.10 p m. on February 24.

Accompanying the foregoing are reports of the Agricultural Instructors for the month of January. Amongst interesting items in these, the following are noted. Ground provisions are fairly plentiful; large quantities of potatoes are being reaped not only by the peasantry, but by estates in the southern portion of St. George's parish. About sixty skins (goat, sheep, and cattle) have been converted into leather at the small tannery recently established at Fontenoy. It is hoped that this will prove a successful minor industry of the colony. An attempt has also been made to place the deep-sea fishing industry on a better footing, by the employment of a boat equipped with both sail and motor power.

The past crop season in Carriacou was very favourable and an unusually large crop of Indian corn was reaped—approximately 15,000 barrels of cob corn, very nearly 50 per cent. larger than that of 1916. There was a much larger yield than usual in sweet potatoes, while the yield of pigeon peas was satisfactory. Cotton, which gave promising growth, is being handicapped by a strong growth of bonavist beans.

ST. VINCENT. The Agricultural Superintendent reports the following plant distribution during the month of February: cane cuttings, 1,500; ornamental plants, 14; cured cacao, 50 lb. Work in the Botanic Gardens was of a routine nature. On some estates the destruction of cotton stalks was started; pickings of good white cotton were made to the end of the month. Mr. Sands records the fact that instances have occurred where the flowers and bolls which would have produced the first pickings were shed to a large extent, and second pickings, due to the absence of plant bugs, saved the situation. During the month 400 bales of Sea Island cotton were shipped to the Admiralty. The weather was favourable for crops, and large areas of ground provisions, etc., were making good progress. The rainfall, registered at the Botanic Station, was 5·27 inches; at the Experiment Station, 5·85.

Appended to the above are extracts from the Cotton Inspectors' report for the month of February, regarding agricultural conditions in Union Island. From these there appears to have been a shortage of the cotton crop during the present season. This is attributed to the following causes: the effect of heavy rains which fell during the planting and growing season; the presence of pests—cotton stainers and leaf-blister mite; improper tillage and the absence of manures; and poor condition of lands.

From a further appendix it appears that work in connexion with the destruction of the native food-plants of the cotton stainer was still in progress.

ST. LUCIA. Work in the Experiment Station during the month of February included the making of farine for supplying Castries, and the manufacture of sweet potato flour for disposal to bakeries. The Agricultural Superintendent, Mr. A. J. Brooks, also reports plant distribution as follows: lime plants, 1,650; oranges, budded, 8; mangoes, grafted, 5; dasheen plants, 300; also 135 packets of vegetable seeds. Regarding the staple crops the picking of cacao was continued, the lime crop was slackening, while reaping operations of sugar were general. Mr. Brooks further mentions the erection of buildings near the Government Lime Juice Factory to establish a Government granary and ground provision depôt. The depôt opened for business from Monday 25th; considerable quantities of provisions have since been purchased and sold, and there is every indication of the venture proving an unqualified success. The rainfall recorded at the Botanic Gardens, Castries, for the month totalled 5·80 inches; the record at the Agricultural and Botanic Station, Choiseul, was 2·96 inches.

ANTIGUA. Mr. T. Jackson, the Agricultural Superintendent, reports the following plant distribution during the month of February: onion plants, 10,300; miscellaneous, 54; and 2 packets and 10 lb. of seed. The exceptional dry weather experienced retarded the growth of all staple crops. The canes in some of the fields were drying up for want of rain. Attempts to plant vegetable crops in some cases failed for the same reason. Reaping operations were in some districts almost brought to a standstill on account of the dissatisfaction of the labourers in connexion with a suggestion made by planters that crops should be reaped by the ton and not by the line. Only indifferent crops of onions can be expected in consequence of the continued drought. Thrips in some cases were attacking onion seedlings in nurseries. The amount of corn meal made at the granary aggregated 6,381 lb. Unfortunately this work cannot be proceeded with, on account of the disintegration of the stone rollers. The Antigua Cotton Growers' Association purchased 7,790 lb. of seed-cotton; the quantity of cotton purchased by the Association amounts now to 23,000 lb. The rainfall for the month, recorded at the Botanic Station, was 1·60 inches; for the year, 2·57 inches.

ST. KITTS. Mr. F. R. Shepherd, the Agricultural Superintendent, in the items of interest forwarded for the month of February, states that 7,875 cane plants, 167 cuttings of ornamental plants, and 100 mahogany seedlings were distributed. In addition, 24 lb. of peas and 1,574 lb. of selected cotton seed were sold. The usual routine work was carried on in the Botanic Gardens. Much watering had to be done until the last few days of the month when 1·85 inches of rain were registered. The reaping of the cane crop was rapidly proceeded with, especially in the district connected with the Basseterre Factory. The returns per acre in the Valley district are low, but the sucrose content is high. The condition of the young cane crop was not promising, but the rains referred to above, it is hoped, will do a great deal towards establishing the young plants. All the old cotton plants were being taken off, and in some places the preparation of the land for the coming crop had been started. The weather was so dry that ground provision crops and corn could not be planted, but an attempt will now be made to plant after the recent rains. During the month 353,824 lb. of cotton lint were purchased on behalf of the Admiralty, and a total of 445,309 lb. of lint is awaiting shipment in St. Kitts-Nevis. The rainfall for the month was 4·30 inches; for the year, 5·36 inches.

VIRGIN ISLANDS. Reporting for the month of January, the Curator, Mr. W. C. Fishlock, mentions plant distribution as follows: onion plants, 381,900; cabbage, 30; tomato plants, 12; vegetable seeds, 12 packets; cotton seed, 15 lb. In connexion with staple crops there was little to report.

Ground provisions, especially potatoes, were more plentiful. The general condition of the cotton crop was not good. Exceptionally severe attacks of cotton worm were reported from all districts. Onion caterpillars were also bad in all places where onions were planted. The rainfall recorded for the month was 1·68 inches, as compared with 2·95, the average for this month for the preceding sixteen years.

DOLICHOS HYBRIDS IN ST. VINCENT.

Among the leguminous plants used for human consumption in the West Indies, the bonavist bean (*Dolichos lablab*) is one of the most valuable. It appeared, however, to the writer, that better varieties than those at present cultivated might be obtained through hybridization. An examination of available material in November 1916 showed that there were at least four different types present in St. Vincent:—

(1) A strong climber, devoid of anthocyanin colouration, with yellowish-white seeds, white flowers, and small pods; ate flowering. (A).

(2) An upright or bush form, devoid of anthocyanin colouration, with yellowish-white seeds, white flowers and small pods; early flowering. (B).

(3) Resembling (A) but with broader pods and larger seeds; late flowering. (C).

(4) A rather weak climber, with a considerable development of purple anthocyanin colouration, purple flowers, purple pods, and black seeds slightly speckled with brown; early flowering. (D.)

Of these, A, B, and C are in general use as food-plants. Form D is chiefly used as an ornamental plant, but Rev. C. H. Branch states that this variety is also edible.

In the spring of 1917 a variety known as *Dolichos giganteus* was obtained from Messrs. Ryder & Sons, of St. Albans. This proved to be quite different from the types mentioned above. The habit was that of type B, but less vigorous; the flowers were pale purple; the development of anthocyanin colouration was feebly marked, the pods being whitish instead of purple; the seeds were black, slightly speckled with brown. This type will be denoted by the symbol (E).

The following hybrids were made: A × D, D × B, and D × E. In the F_1 generation of A × D the habit was similar to A, but more vigorous. Flowering did not take place until the plants were several months old. The exact date of flowering was not recorded, but the late flowering habit certainly behaves as a dominant. The development of anthocyanin colouration was intermediate; the flowers were purple and indistinguishable from D; the seeds were black, slightly speckled with brown, and indistinguishable from those of D.

In the F_2 generation of A × D, segregation in respect of the climbing habit, the time of flowering, and the development of anthocyanin colouration was observed. It appeared that there was a genetic correlation between the presence of anthocyanin colouration in stem, leaves, and pod, and the purple colouration of flower and black testa of the seed, i e. all plants showing any anthocyanin in stem or leaves possess also purple flowers and black seeds speckled with brown, whilst if a plant has no anthocyanin in stem or leaves, its flowers are pure white, and its seeds are yellowish-white.

The following numbers were obtained:—

Anthocyanin present in stem, leaves, and pods, flowers purple, seed black speckled with brown, 39.

Anthocyanin absent, flowers white, seeds yellowish-white, 12.

This ratio approximates to the normal Mendelian one of 3:1.

No further studies were made with this cross.

In the F_1 generation, of B × D, the climbing habit of D was completely dominant. The amount of anthocyanin colouration was again intermediate, the flowers being purple, and the seed coat black, speckled with brown.

In the F_2 generation B × D several hundred plants were grown, and these were examined for (a) climbing or dwarf habit, (b) presence or absence of anthocyanin colouration. It may be observed that the segregation of the dwarf or bush habit was very sharp, and no difficulty was experienced in classifying the plants.

Climbing habit.		Dwarf habit.	
Anthocyanin present.	Anthocyanin absent.	Anthocyanin present.	Anthocyanin absent.
451	147	155	44
Expectation on 9:3:3:1 basis.			
448·2	149·4	149·4	49·8

From these figures we are justified in concluding, tentatively at all events, that the presence and absence of anthocyanin colouration form a Mendelian pair, and, as was found by Mendel himself in Pisum, another Mendelian pair is formed by the climbing and dwarf characters.

In regard to the economic aspect of this work, selections are being made for yield and table qualities. Although this work has not proceeded very far as yet, the results are encouraging.

In the *Journal of the Board of Agriculture of British Guiana* for April-July 1917, Mr. J. F. Waby has described a hybrid Dolichos which he calls *Dolichos lablab*, var. *macrocarpa*, Waby. This is said to be a natural hybrid between two varieties known as Park Runner and Vilmorin's Stringless. So far as we can see, Mr. Waby has described a heterozygous type as a new variety—a procedure of doubtful biological validity. We await with great interest an account of the behaviour of the F_3 generation from the single F_2 plant which he was able to save.

In case any readers of the *Agricultural News* wish to hybridize the bonavist bean, the following short account of the method adopted by the writer may be useful. Take a bud which is unopened and the anthers of which are unburst, and with a needle carefully slit the edge of the keel, being careful not to injure the stigma. Then with a pair of forceps, nip off the anthers. On the following morning pollen from the male parent may be applied to the stigma with a small camel's hair brush. This method is quite easy, and 90 per cent. of successes have been obtained thereby by the writer.

S.C.H.

The Antigua Government Granary.—Mr. A. E. Collens, Acting Superintendent of Agriculture for the Leeward Islands, reports that unfortunately the surface of the millstones at the granary began to disintegrate towards the end of February which spoiled the meal with particles of grit. This occurred in grinding hard imported corn. Orders have been sent to England for duplicate sets of stones; and meanwhile it is hoped that the present set may be able to deal with local corn, which is not so hard as that imported.

It is unfortunate that this break down should have occurred just when the granary was satisfactorily producing from 800 to 900lb. of meal a day, and was proving of great utility to the community.

COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending February 16, 1918, is as follows:—

ISLANDS. There has been a demand this week for odd bags classing Fine to Fully Fine at 73c. to 73½c., resulting in sales on account of the Northern Mills, who find this quality better and relatively cheaper than Fancy Georgias and Floridas.

The market closed firm, with Factors unwilling sellers under 73½c. to 74c., the larger portion of the unsold stock being held at 74c.

This crop is being rapidly disposed of, there remaining now unsold only about 700 bales, classing Fine to Fully Fine, and 400 bales classing Extra Fine. The latter consists of Planters' crop lots held at 80c. to 85c.

We quote, viz:—

Fine to Fully Fine	73c. to 74c. = 75½c. to 76c.	c.i.f.
Fine, off in preparation,	70c. to 71c. = 72c. to 73c.	,, ,,

GEORGIAS AND FLORIDAS. Although the Factors continue very firm, refusing to make any concessions to sell, there is only a limited inquiry, resulting in some sales at prices ½c. to 1c. below quotations of small lots that were sold. The buying is on account of the Northern and Southern mills.

We quote, viz:—

Extra Choice to Fancy	73c. to 74c. = 75½c. to 76c.	c.i.f.
Average Extra Choice	73c. = 75c.	,,

The exports from Savannah for the week were, to Northern Mills 100 bales, and from Jacksonville to Northern Mills 436 bales.

BRITISH COTTON GROWING ASSOCIATION.

There was a large attendance of members present at the one hundred and sixty-eighth meeting of the Council of the British Cotton Growing Association, which was held at the Offices, 15 Cross Street, Manchester, on Tuesday, the 5th instant.

A letter from the President (The Rt. Hon. the Earl of Derby, K.G.) was read regretting his inability to attend owing to important business in London, and at his special request the Chair was occupied by Sir Frank Forbes Adam.

RESIGNATION OF THE CHAIRMAN. A letter from Mr. J. Arthur Hutton, addressed to the President, was read, regretting that he was no longer able to carry on the work of the Association as it should be done, and asking that his resignation as Chairman of the Council might be accepted. A letter from the President was also read stating that it was with extreme regret that he had received the resignation of Mr. Hutton as Chairman of the British Cotton Growing Association, and expressing the wish that he could be present at the meeting at which such resignation was to be considered. The President alluded to Mr. Hutton's past great services, and hoped that he would speedily be restored to good health, and be able to give the Association the benefit of his advice while not having to stand the strain that the Chairman must have.

Sir Frank Forbes Adam referred to the work which Mr. Hutton had done to promote the interests of the Association. By his ability, energy, and zeal, and often under difficulties and discouragement, Mr. Hutton had, along with those co-operating with him, made the Association what it is to-day. It was greatly to be regretted that the state of his health would not permit of Mr. Hutton continuing to stand the worry which the Chairmanship of the Council entailed. His resignation must be taken to be definite and final. The following resolution proposed by Sir Frank Forbes Adam, seconded by Mr. Howarth, and supported by Messrs. Hayhurst and Crinion, was unanimously approved:—

> 'That the Council of the British Cotton Growing Association has learned with profound regret of the resignation of Mr. J. Arthur Hutton from the Chairmanship of the Council, and desires to place upon record its most grateful thanks for his whole-hearted and unremitting devotion to the best interests of the Association since its inception.
>
> 'It recalls with gratitude the ability with which he has guided the Association's policy and work through many difficulties, until it has attained its present recognized position as an Empire Institution, with every promise that its work and example will ultimately result in a large increase of British Empire grown cotton.
>
> 'The Council earnestly hopes that Mr. Hutton will, as one of its members, continue to give its deliberations the benefit of his experience and advice.'

It was proposed by Sir Frank Forbes Adam, seconded by Mr. Crapper, and spoken to by Messrs. James Brown and D. Marriage and others, and unanimously resolved:—

> 'That Mr. Hutton be elected a Vice-President of the Association.'

Mr. A. V. Paton (President of the Liverpool Cotton Association) in supporting this resolution, spoke of the inestimable value of Mr. Hutton's services to the Association. He regretted that the Government had not done more in the past to assist the Association's work, and he assured the Council that if Liverpool could do anything to help the Association in their representations to the Government, they would be delighted to do so, as they were of opinion that the work of the Association was of the utmost national importance.

It was decided not to appoint any permanent Chairman to fill Mr. Hutton's place, but that the work should be carried on by the present Executive Committee with the co-operation and general superintendence of the Manager, Mr. Himbury.

The Executive Committee have decided to meet more frequently for the purpose of keeping the closest possible touch with the work, and to meet at regular intervals, and practically act as a Board of Directors.

WEST AFRICA. The purchases of cotton in Lagos for the year 1917 were 7,807 bales, against 9,286 bales for 1916, and 6,161 bales for 1915.

In Northern Nigeria the total purchases for 1917 amounted to 3,829 bales, as compared with 10,746 bales for 1916, and 1,128 bales for 1915. A cable has recently come to hand advising the purchases in Northern Nigeria for the month of January as 536 bales.

It is too early yet to form a reliable estimate of the size of the new crop, but the Association's Local Manager reports that the crop in Lagos is expected to be about the same as last year. In Northern Nigeria the new crop is now beginning to come in, and is estimated at 6,000 bales, of which 1,500 bales will be long staple cotton which has been grown

under the auspices of the Government Agricultural Department. Considering the great difficulties caused by the war, a crop of 1,500 bales of long staple cotton is very satisfactory, as it compares with 461 bales of this cotton last year, and when once the cultivation of this long staple cotton has been established, it is felt that the future of the cotton-growing industry in Northern Nigeria will be assured.

UGANDA. The latest reports are to the effect that the cotton crop will not be so large as had been expected, and the total crop is estimated at about 20,000 bales.

COTTON EXPORTS FROM THE WEST INDIES.

The following figures show the quantity and estimated value of Sea Island cotton exported from the West Indies for the quarter ended December 31, 1917:—

Colony.	Quantity, lb.	Estimated value, £.
Grenada	217	33
St. Vincent	54,565	8,232
Barbados	4,618	115
Montserrat	48,664*	7,561
Antigua	nil	nil
St. Kitts	,,	,,
Nevis	,,	,,
Anguilla	,,	,,
Virgin Islands	5,905†	130
Trinidad	450	75
Total	115,119	16,146

*The cotton shipped from Montserrat was made up of 21,563 lb. of lint, and 108,405 lb. of seed-cotton, equal to 27,107 lb. of lint, making the total lint 48,664 lb. as shown above.

†This cotton is presumed to be Sea Island, quality unknown.

In addition to the above there were exported of Marie Galante cotton from Grenada, 274,596 lb., and from St. Vincent, 44,363 lb., of the estimated values of £9,150, and £3,327, respectively.

EXPERIMENTS WITH TANNIAS IN THE PHILIPPINES.

The *Philippine Agriculturist and Forester*, November 1917, contains an interesting article by Francisco A. Abadilla on experiments in the cultivation of what are called in the Philippines yautias and gabis, or, as we know them in the West Indies, tannias and eddoes. The gabis or eddoes (*Colocasia* spp.) have been planted from very ancient times in the Philippines, but no care has usually been taken in weeding or manuring the crop. The yautias or tannias (*Xanthosoma* spp.) have been introduced comparatively recently from the American tropics, and have been found to do well in many parts of the Philippines. They appear also to be less susceptible to diseases which attack the gabis or eddoes there, and are much more productive, and more resistant to drought.

The experiments referred to above, show that it is advisable only to use the tops of the old root-stocks in planting. They develop earlier and produce from 15 to 20 per cent. more tubers in shorter time than when tubers are used.

As to fertilizers, stable manure gives the best results, while the application of chemical nitrates and phosphates is not advised.

A method called castration is mentioned as a means of increasing the production of the crop. This consists in removing the soil around the plants, and then taking up the ripe tubers for use. The soil is then put back. It is stated that by this method in eighteen to twenty-four months as much as 30 tons of tubers can be harvested from 1 acre.

In the cultivation of the crop in the open, the plants were spaced about 3 feet apart and set from 5 to 7 inches deep. The same distances and depth were observed in the experiment of planting between the trees in a coco-nut grove. During the first month after planting, cultivation of the soil surface once a week was found necessary. During the next two months this was done once a fortnight, and afterwards until the time of harvest, once a month was found to be sufficient. In fact the tannias planted in the coco-nut grove only needed one cleaning after the third month.

The crops were harvested at the age of seven months. From the tables of returns given, the yield seems to have been much larger than crops obtained from the same varieties of tannias grown in the West Indies. To take as an instance the variety known as Rolliza, which has been grown at the Experiment Station, Antigua, for some years; according to the Report on the Agricultural Department in that island, 1915-16, the calculated yield of tubers from that variety was 6,138lb. per acre; and the yield in the experiments in the Philippines with the same variety in the open field is given as 15,644 kilogrammes per hectare, which is roughly equivalent to 13,768 lb. per acre; while as an intercrop among coco-nut trees an equivalent of 11,664 lb. per acre is given as the result from the same variety. In the open field the production of the varieties varied from nearly 5 to more than 13 tons per acre. It was also demonstrated by experiment that wider spacing of the plants than 3 by 3 feet led to a loss per acre of from 2 to 18 per cent. Such wider spacing was therefore not only unnecessary but wasteful.

As a catch crop in a coco-nut plantation, promising results were obtained from the tannias, none of the ten varieties planted producing much less than 5 tons of root-stock per acre. The production varied, according to the variety, from nearly 5 to more than 10 tons per acre, in spite of the fact that the crop was well shaded by the coco-nut trees. In this situation it was only necessary to weed and cultivate the plants four times in seven months. In fact cultivation was only to insure the plants a good start, for after they had out-grown the weeds, their own shade and the shade of the coco-nuts kept the weeds down. Of course such intercropping tends to impoverish the soil, and therefore it may be advisable to apply fertilizers to the coco-nut trees more liberally than if no such catch crop is grown. It is recommended that if a coco-nut grove is to be thus intercropped with tannias, the cultivation should only be practised when the trees are young.

In conclusion it may be noticed that in these experiments the crops were reaped after seven months' growth, and it is considered that even better results would have been obtainable had the plants been given more time to mature, as tannias really require from eight to twelve months to attain their full maturity. It is also pointed out that uniform growth, and good results are obtained by using only the upper part of the mother root-stock for planting.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

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Entomologists	H. A. Ballou, M.Sc.† J. C. Hutson, B.A., Ph.D.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The subject of the editorial in this number is Botanic Gardens, with reference to their origin and function.

Insect Notes on page 90 describe the red spider or spider-mite, and discuss measures for its control.

On page 94, under Plant Diseases, are given hints for the protection of citrus fruit from rots during shipment.

Interesting notes on the hybridization of varieties of bonavist beans will be found on page 85.

Mr. J. A. Hutton.

As will be seen in the report of the meeting of the Council of the British Cotton Growing Association on February 5, printed on another page, Mr. J. A. Hutton, owing to the state of his health, has felt himself obliged to resign his position as Chairman of the Council. Mr. Hutton has been intimately connected with the establishment of the cotton industry in these islands, and the putting of it on a sound basis. His disinterested efforts in forwarding the progress of the industry have been continuous; and we are sure that we voice the feeling of the cotton growers of the West Indies in expressing the most grateful appreciation of his efforts, and profound regret for the cause of his resignation of his office. We sincerely hope that Mr. Hutton will soon be restored to health.

Index to the 'Agricultural News'.

With this number of the *Agricultural News* is published, as a supplement, the index to Volume XVI. This may be bound at once in the usual manner with numbers 384 to 409, of which Volume XVI is comprised.

The index should prove useful for purposes of reference on all matters relating to tropical agriculture, and will be of value as a guide to concise information on insect pests and fungus diseases of tropical cultivated plants.

By-products of the Sugar-cane Industry.

In the *Agricultural News*, February 9, 1918, attention was drawn to possible developments in the direction of the utilization of waste-products of cane-sugar manufacture. Such developments are already taking place in Natal. According to the *South African Sugar Journal*, November 15, 1917, the Natal Cane By-products Co., Ltd., have erected a factory for the purpose of utilizing molasses on an extensive scale in the production of various grades of alcohol, and also for the manufacture of cane wax.

The factory contains distillation plants of large capacity and most efficient pattern. In the large underground tanks something like a million gallons of molasses can be stored for treatment, and it is believed that the petrol shortage in South Africa will be materially relieved by the production of considerable quantities of of 'Natalite', a form of alcohol specially adapted for use in combustion engines.

One of the features of the factory is a yeast culture plant, one of the most modern of its kind in the world, where the various yeast ferments wanted in the distilleries are cultivated. For, in addition to 'Natalite', the company's products will include rectified and methylated spirits; in fact alcohol for all industrial purposes. The rectified alcohol will be the purest kind produced, and will be welcomed by perfumers, drug compounders, etc. There is also in the factory a still for the manufacture of ether, consisting of an enormous

lead-lined kettle, with purifiers and rectifiers, capable of producing 3,000 gallons of pure ether in twenty-four hours.

Another product of the company's factory is cane wax. The plant for the manufacture of this is working most satisfactorily, and several hundred tons of the wax have been placed on the London market. The refined product is equal in quality to the best Carnauba wax, and fetches a remunerative price.

Basic Slag as Affecting Agricultural Developments.

A review of experience in Europe and the United States on the use of basic slag and rock phosphate for fertilizer, published in the *Journal of the Society of Chemical Industries*, 36 (1917), is briefly referred to in the *Experiment Station Record* for December 1917. In the investigations special attention was given to the difference between the citrate solubilities of the basic slag derived from the Bessemer steel process, and of that derived from the English basic open hearth process.

The conclusion is drawn that 'citric solubility is certainly not the only criterion, and is apparently not even a reliable criterion, of the value of phosphatic material as a manurial agent. It is therefore submitted that total phosphoric acid content is a far more reliable test of manurial value, and possesses the further advantage that it depends on the definite analytical determination of a substance, instead of being an empirical test liable to be affected by the conditions and methods of its application, and that it should therefore be authoritatively substituted for the citric solubility test throughout the country.' This change would not only render available for the use of British agriculturists an annual amount which may reach up to 100,000 tons of phosphoric acid, but would at the same time render valuable assistance to the steel trade of the country.'

A Huge Central Factory in Cuba.

The gigantic sugar factory of Central Cuba, known as the Central Stewart, was built in 1907 by Messrs. Duncan Stewart & Co., Ltd., of Glasgow, from whom it takes its name, and was originally designed to deal with 2,300 tons of cane per day. Extensions were made year by year, until it now has a capacity of dealing with over 6,000 tons of cane per day. According to an article in the *South African Sugar Journal*, November 15, 1917, the estate covers an area of over 43,000 acres, and is intersected by more than 60 miles of standard-gauge railroad with a full complement of heavy locomotives and cane and sugar cars.

The milling plant consists of three trains of 36-inch mills, two trains being 6 feet wide, and the third 7 feet wide, each with a Krajewski crusher. The steam generating plant consists of twenty-four multitubular steam boilers, each 8 feet in diameter by 22 feet in length.

A Breadfruit with Developed Seed.

The breadfruit tree (*Artocarpus incisa*) is, as all West Indians know, reproduced from root-suckers, because the fruit is seedless. It is perhaps not so generally recognized that the bread-nut tree, which is not uncommon in these islands, is only a seeding race of the same species. This also is almost always reproduced by root-suckers, and the two races have been kept distinct, and have remained true to type since the introduction of the tree into the West Indies from the Pacific Islands at the end of the eighteenth century.

Occasionally, however, a seed has been found in a breadfruit. Recently Mr. J. C. Moore, Superintendent of Agriculture, Grenada, sent to the Imperial Commissioner of Agriculture a photograph of a section of a breadfruit in which a seed was developed, which was similar to the seed of the bread-nut, but somewhat rounder. The photograph was forwarded to Sir David Prain, Director of the Royal Botanic Gardens, Kew, as of interest.

There has been some question as to whether the breadfruit, at least the seedless variety, was cultivated in Cuba. The botanist of the Experimental Station at Santiago de las Vegas has however written in reply to an enquiry made on the point by the Imperial Commissioner of Agriculture, that both forms of the fruit, seeding and seedless, occur under cultivation in Cuba, having been introduced there from Jamaica very many years ago.

The Cultivation of Celery.

Instructions for the cultivation of celery are given in the *Bulletin des Chambres d'Agriculture de la Guadeloupe et Dépendances* for October 1917, which may also be of use in other West Indian islands.

Celery seeds should be sown in a box at any time from September to December. The seedlings should be picked out when quite small, and transplanted several times until they are strong. When they are to be permanently planted the roots and leaves ought to be trimmed. Trenches from 1 to 1½ feet deep should be dug in a well prepared bed, and the plants set out at a distance of about 1 foot apart at the bottom of the trenches. As the plants grow the trenches are to be filled in by the soil which had been removed. When the bed has thus become level, the plants should be moulded up every week. Celery needs frequent watering, the quicker it grows the more tender are the stalks. It can be blanched by tying the stalks of the leaves together in a bunch, or by lifting the plants with a ball of earth round the roots, placing them side by side in a trench, and filling it with mould. The latter would seem perhaps to be the more practicable method under West Indian conditions.

INSECT NOTES.

THE RED SPIDER.

(TETRANYCHUS TELARIUS, L.)

The common red spider or spider-mite is of almost world-wide distribution, and sometimes becomes numerous enough to be a pest on certain cultivated crops. It is usually troublesome wherever plants are grown in greenhouses. Within recent years it has come to be recognized as a periodically serious pest of cotton in the South-eastern United States, and during a red-spider year the losses from the ravages of this small mite in the cotton belt are severe, amounting, it is estimated, to $2,000,000. Much of the following information on this species is taken from *Bulletin 416* by Messrs. E. A. McGregor and F. L. McDonough, of the United States Department of Agriculture, and from *Farmers' Bulletin 831* by the first of these two authors.

The name *Tetranychus telarius*, L., is that given to the original European red spider, and is the one that is apparently being used at present. The minute size of these creatures, and their great variations due to age, host plant, environment, etc., have led to a confusion of names. Among the commoner scientific names used in literature for the red spider are *T. bimaculatus*, Harvey, and *T. gloveri*, Banks.

DESCRIPTION OF THE RED SPIDER.

This minute creature is not a true spider but a mite, and is more closely related to the ticks than to the spiders. As is usually the case with mites, the full-grown male and female have eight legs but no wings. The colour of the female varies considerably. 'At times it is rusty green, sometimes greenish amber, occasionally yellowish, at times almost black, but most often brick-red, and a large spot of much darker colour is usually seen along the back half of each side of the body.' The females are less than one-fiftieth of an inch in length, while the males are considerably smaller, more pointed behind, of a rusty salmon colour, and the spots at the sides are not conspicuous.

LIFE-HISTORY SUMMARY.

Egg. The red spider lays its eggs on the under surface of the leaves of a great variety of plants. The eggs are almost complete spheres. When freshly laid they are quite clear and almost transparent, but gradually become opaque, and are a dark honey-yellow just before hatching. They are deposited singly on the underside of the leaf surface or on the fine webbing sometimes spun by the mites just above the surface of the leaves.

Female. The egg hatches in about four days to a minute, colouriess, six-legged creature known as a larva. This feeds, and in about two days under summer conditions sheds its skin, and becomes an eight-legged form called the primary nymph, which is usually greenish or yellowish. After feeding there is another moult in about two days, and the secondary nymph appears. This gradually becomes more like the adult, and changes to the female in a little less than two days. Thus under favourable conditions the female takes between nine and ten days to develop.

Male. The development of the male is very similar to that of the female, except that there is no secondary nymphal stage. It is found, however, that the other stages are slightly lengthened, so that the males usually take one day less than the females to develop.

FEEDING AND INJURY.

The feeding is done by means of sharp, slender, lance-like mouth parts which pierce the leaf-surface, usually on the underside. The injury is caused by the extraction of the plant juices, and in a heavy infestation the leaves curl up, wither, and usually drop. In the case of cotton, the presence of the red spider is usually first indicated by the appearance of red blotches on the upper surface of the leaves, and in severe cases the foliage withers and drops, and this dropping is accompanied by boll shedding. Other plants attacked by red spider do not as a rule show the red blotching, but yellowish patches appear on the upper surface, which gradually spread.

FOOD-PLANTS.

The red spider has been found breeding in the United States on over 180 different kinds of plants, including weeds, ornamental plants, garden and field crops. A few of these plants are specially attractive to this pest, and it is on these that the infestation of the red spider in the cotton belt is mainly concentrated. Some of these serve as over-wintering hosts of this pest, while others support it during the spring and summer. It was found that the cultivated violet is one of the most important wintering hosts, and serves as a source of dispersion to adjacent weeds and neighbouring cotton fields in the spring. The garden beans (*Phaseolus* spp.) are important host plants during the summer months, and are therefore a constant menace to surrounding crops. The red spider is generally found on cotton in the south-eastern States when this plant is availab'e, but in the great majority of cases the infestations on this plant are very slight. Outside the cotton season the red spider is supported on a number of plants, both weeds and cultivated plants, from which it spreads again to the cotton.

DISPERSION.

It has been shown that when the food supply becomes exhausted on one set of host plants, the red spider is able to migrate by crawling to another set of plants, and so on all through the year. For instance, when cotton and other annual plants die in the autumn months, the red spiders migrate to various weeds and to certain cultivated plants, such as the violet, which remain green throughout the comparatively mild southern winter. With the coming of spring this pest returns to the weeds which are often left growing on borders of cotton fields, and thence to the cotton as it appears. Red spiders may also be washed off by heavy rains and carried on the surface water to other parts of a field, where the survivors are able to start a new infestation. They may also be blown from place to place by heavy winds, or they may travel directly from one plant to another by means of the interlacing branches.

NATURAL ENEMIES.

In the United States the red spider on cotton is known to be attacked by thirty-one predaceous enemies, including other mites, thrips, predaceous bugs, lacewing flies, larvae of syrphid flies, larvae of midges, coccinellid beetles, etc. These predatory enemies, however, are known to be attacked by seventy-five species of predaceous and parasitic enemies, so that their usefulness is somewhat lessened

REMEDIES FOR THE RED SPIDER.

The measures against the red spider in the cotton belt of the United States fall under two main headings, preventive measures and repressive measures.

Preventive measures. These are far more economical and practical than measures of repression. They include the destruction of weeds round cotton fields during winter and early spring, the control of the red spider on cultivated plants in yards, etc., by spraying, the maintenance in cotton fields of a finely pulverized surface mulch in order to retard the migration of the red spiders, the judicious use of fertilizers to keep the plants in good health and therefore more resistant to injury. The use of a fine surface mulch would

only be practicable where the plants are spaced widely enough to avoid interlacing of the cotton branches. Weeds can be killed by spraying them with a solution of 1 lb. of sodium arsenate in 20 gallons of water.

Repressive measures. These include measures which have to be taken against the red spider after it has invaded the cotton fields. Dispersion in an infested cotton field may usually be prevented by pulling up and destroying the first infested plants. This must be done before the infestation has gone very far. Otherwise, in the case of a general attack, spraying should be resorted to. And since the red spiders as a rule are found only on the underside of the leaves, great care must be taken in spraying to hit the entire underside of every leaf of an infested plant. Furthermore it has been shown that no safe insecticide is known which will destroy red spider eggs, so that a second spraying is necessary to kill those mites which have hatched out since the first spraying.

Out of seventy-five different spray mixtures tried against the red spider on cotton, the following have proved entirely satisfactory: (1) potassium sulphide (1 ounce to 2 gallons of water); (2) lime-sulphur (home-made or commercial); (3) kerosene emulsion; (4) flour paste solution. It may be mentioned here that arsenical sprays are of no use against the red spider.

THE RED SPIDER IN THE LESSER ANTILLES.

The red spider cannot be regarded as a serious pest in these islands, judging from the monthly and annual reports of the agricultural officers in the various islands, and from personal observations.

It is sometimes fairly common on sweet potato, and on some peas and beans, and occurs on cotton, but its attacks usually occur only in the dry season, and are not of long duration. In Barbados the writer has observed the larvae and adults of a minute staphylinid beetle attacking the red spider, mainly in the immature stages, and it is claimed that this small predator is very effective at times. A predaceous thrips has also been observed on leaves of Lima bean infested with red spider.

J.C.H.

MULES.

We are indebted to the London correspondent of the *North Queensland Register* for the following notes on mules, which will doubtless be of some interest to our readers. In a series of articles recently contributed to the *Brisbane Courier* there are some interesting notes about mules, which are to be introduced into Queensland in numbers. The usefulness of mules depends in a great measure upon the circumstance that they combine in a remarkable degree the constitutional attributes of their parents on both sides. Descended originally from the species of wild ass inhabiting the rocky semi-desert of Upper Egypt, where food is scarce and the heat intense, the jacks transmit to their hybrid progeny the faculty for resisting privation and withstanding tropical heat, which horses do not possess.

The value of mules can hardly be overestimated. This has for a long time been realized in most parts of the world, although in England and Australia ignorance and prejudice have debarred their use on any big scale.

The testimony of those who have had experience of both horses and mules is convincing as to the superiority of the latter in tropical regions. They live longer, and are able to withstand the effects of hard work for a greater number of years; they are constitutionally stronger, and less liable to sickness to which horses are subject; they can be kept on coarser and cheaper food, and they are hardier and able to resist extremes of temperature, especially heat. Their narrow and small hoofs make them more sure-footed than horses, and they can pick their way over mountains and on the edge of precipices without much risk of disaster, and in positions such as these show more pluck and caution than horses.

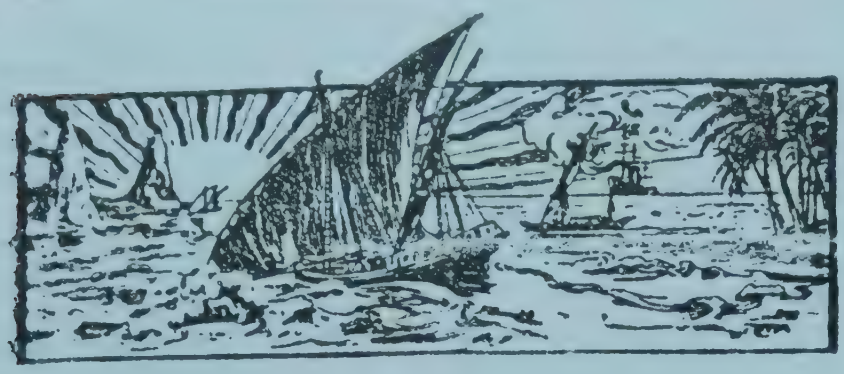
The all-round advantages of mules over horses in the way of economy or keep outweigh the disadvantages with respect to certain uses. It is conceded at once that a mule is not as fast as a horse, and the heaviest draught mules are not as good as the heavy Clydesdales for actual pulling power; but an ordinary team of mules will beat the ordinary team of horses for pulling and for travelling great distances where food is scarce.

There are two distinct types of jacks in Europe. Those for getting heavy draught mules are bred in Poitou, in the west of France. The height of these is about 15 hands. In America, where hundreds of thousands of mules are bred each year, the Spanish or Catalonian jacks are the most popular. The Kentucky mules are famous all over America, and owe their fame to two Catalonian jacks imported to America about 1830 or 1840, and crossed with the ordinary female donkeys of the State. They have produced a most useful strain of mule-breeding jacks. It is said that all the best mules in America owe their quality to their descent from those two jacks. So highly appreciated are mules in the Western States that in 1890, 150,000 were foaled. At the present time something like 200,000 mules are foaled annually.

Anyone who has visited America must be struck with the numbers used. One sees them doing heavy dock work and railway work in the country, ploughing and ordinary farm work, and they are invaluable in mining and pack work. They will carry more than 200lb. over rough, high country, if properly loaded.

It is generally considered that three mules can be kept on fodder that would only be sufficient for two horses. They are peculiar creatures, and it has been proved they will pull better if a mare is in the lead, for, having been foaled and brought up by mares, they have a great affection for horses, and a corresponding dislike for asses. The objection that is taken to mules on the score of bad temper and obstinacy may be dismissed by the remark that, in the opinion of competent judges, these so-called vices are the outcome of mismanagement and cruelty to beasts of highly nervous temperament, which require kindness and intelligence in handling.

Production of Beeswax in British East Africa.—A brief note appears in the *Journal of the Royal Society of Arts* for February 8, 1918, on this subject. The gathering of beeswax in the East Africa Protectorate is said to be almost entirely in the hands of the natives, who obtain the product from wild hives in the country. Very little scientific apiculture is practised, and that only by the European settlers in the highlands. Notwithstanding the present small production of honey and beeswax, writes the United States Consul at Mombasa, the higher altitudes of the colony are peculiarly well adapted to apiculture. Clover is an abundant crop, and other flowers are plentiful. There are two rainy seasons, no winters, and so far no serious bee diseases have developed. The Government is giving every encouragement to the industry, and the active interest of the settlers is being aroused to the opportunity. It is believed that the near future will witness a substantial development of the industry.



GLEANINGS.

Liquid manure is applied to the roots of young plants to push them on, and should not be sprinkled over lettuces and cabbages ready for cutting. Apart from this being a most insanitary practice, the liquid manure would burn the leaves. Only the purest of pure water should be applied to plants like lettuce. (The *Journal of the Jamaica Agricultural Society*, January 1918.)

A report by the Imperial Institute on samples of castor seed grown in Northern Rhodesia states that the seeds contained a normal amount of oil, and were in good condition. The maximum controlled price of castor seed in the United Kingdom was £37 per ton in August 1917, but in normal times the value is only about £11 per ton. (The *Rhodesia Agricultural Journal*, December 1917.)

In searching for uses to which molasses might be put it seems very probable that solidified molasses may become a practical proposition some day, and a remunerative one also. Java has produced 96,281 tons of solidified molasses, and the output of this commodity is steadily increasing, it having been less than 67,000 tons in the previous year. (The *South African Sugar Jonrnal*, November 15, 1917.)

An exhibition of the products and industries of the Turks and Caicos Islands was held on January 24, 1918; 789 exhibits were presented under nine classes. In the agricultural class there were 143 exhibits, sixty-two of which were of beans and peas, and thirty of Indian corn. The exhibition seems to have been a very great success, according to the report of the Committee of Management.

Owing to the enormous demand in Japan for sulphate of ammonia, and the consequent rise in prices one Japanese carbide factory, with a capacity of from 25,000 to 30,000 tons per annum, is now concentrating its efforts on the production of sulphate of ammonia, the ammonia being made from calicium cyanamide produced from the carbide by the fixation of nitrogen drawn from the air. (*The Board of Trade Journal*, January 10, 1918.)

According to *Colonial Reports*—Annual, No. 945, for 1916-17, the natives of Swaziland are beginning to use ploughs more generally in their agricultural operations. They do not grow enough food crops however for their own requirements, and the shortage is made good by imports of grain from the Transvaal. The principal crops of the natives are mealies, Kaffir corn, ground nuts, pumpkins, melons, and sweet potatoes.

In Zululand a fair average yield seems to be about 30 tons of cane to the acre, and it ranges as high as 50 tons or more. This would seem to prove that in the matter of growing cane that country is not far behind many of the best sugar-producing countries in the world, while it actually gives a much higher return per acre than an old-established sugar-growing country like Louisiana. (The *South African Sugar Journal*, December 1917.)

In the Philippines it has been repeatedly demonstrated that *Phaseolus lunatus* answers the purpose as a cover crop for rubber better than perhaps all other plants that have so far been tried. *Passiflora fœtida* (known in the West Indies as Love-in-a-mist) also makes an excellent cover crop, but does not enrich the soil to the same degree as *Phaseolus lunatus*. (The *Philippine Agricultural Review*, Vol. X, No. 3.)

The Director of the Agricultural Experiment Station at Santiago de las Vegas, Cuba, has just announced that extensive experiments will be carried on there in developing better varieties of canes from seed, and in the event of varieties appearing which are better than those now planted in Cuba, these will be distributed among the planters much after the system now in use at the Audubon Park Experimeut Station in New Orleans. (The *Louisiana Planter*, March 2, 1918.)

A note in the *South African Sugar Journal*, November 15, 1917, states that sweet potatoes and garden vegetables are planted in Cuba between the rows of sugar-cane in the fields. It is held that by this means not only are valuable crops grown, but the multiplication of weeds is greatly diminished. Maize and English potatoes even are grown between the rows of cane while the latter is still too small to overshadow the other crops. This has resulted, amongst other things, in improving the quality of the cultivation, which was sadly needed in many parts of Cuba.

In the Lawton method of preserving perishable foodstuffs the produce is kept under anærobic conditions so that putrefactive and other changes are arrested, but the objection to it is that the gas used contains carbon monoxide, forming an explosive mixture in the preserving chamber. Dr. S. A. Kapadia has made an improvement in the system by using a gas consisting of nitrogen and carbon dioxide, with only a trace of oxygen. Salted fish kept in the preserving chamber for six weeks appeared to an expert to be in exactly the same condition as when introduced. (*Nature*, February 7, 1918.)

It is a matter of regret to all botanists that South America, so rich a storehouse of botanical treasures, should contain but few important botanic gardens. The magnificent garden at Rio de Janeiro, which was founded in 1808, the Botanic Gardens at Santiago in Chili, at Georgetown in British Guiana, and at Buenos Aires represent the measure of botanical enterprise in the Continent. The botanical possibilities at Rio de Janeiro are very great, and the garden, in addition to its collection of living plants, possesses the herbarium of Martius, a library, and laboratories. When interest in botanical science becomes fully aroused in Brazil, a striking development of the Botanic Garden may be confidently expected. (*Annals of the Missouri Botanical Garden*, Vol. II, Nos. 1 and 2.)

REPORT ON THE AGRICULTURAL DEPARTMENT, NORTHERN PROVINCES, NIGERIA, 1916.

This report, which was issued in November 1917, contains much matter of interest with regard to tropical agriculture.

Besides the general summary of the Director of Agriculture, Mr. P. H. Lamb, the report contains a special appendix by the Chief Veterinary Surgeon, and two detailed accounts by the Assistant Superintendents of Agriculture on the two government plantations at Maigana in the Sokoto district, and Ilorin in the Yoruba country, together with a report on the Horticultural Station at Kaduna by the Horticultural Overseer.

Mr. Lamb, while noticing the reduction in number of the Europeans on his staff, owing to causes arising from the war, highly commends the work done by his West Indian overseers and native officers.

Owing to the sharply defined dry and rainy seasons in those provinces, the exact date of sowing each crop is of the utmost importance if the best yields are to be secured. Thus in the year reported on in some parts of the provinces the dry season set in suddenly and prematurely, causing considerable damage to the cotton crop through severe boll-shedding, and interfering with the ripening of the ground nut crop, with the result that only the earliest sown plots gave an average yield.

Considering that the experimental work on the plantations and in the horticultural station has only been going on for four years, the results so far obtained are very encouraging. The aim is to improve and develop the existing agricultural industries, and to introduce new ones which may be profitably undertaken as subsidiary to those already in existence. Thus with regard to cotton, the cultivation of long staple cotton, especially in the province of Zaria, has been largely extended and placed on a more secure foundation. This was evidently the result of the work on the Maigana plantation.

Approximately 44 tons of cotton seed were distributed as compared with 5 tons in the previous year. Great credit is given to the three itinerant agricultural instructors for the way in which they performed their duties of supervising the sowing and subsequent care of the crop, and the expurgation of objectionable types, which has led to a high grade of cotton being reaped. The plan of making cotton cultivation more attractive to the native grower, by making it more profitable, has been greatly assisted through the establishment by the British Cotton Growing Association of depôts for buying the cotton direct from the producers at a fair price. The native growers realize not only that the long staple cotton is worth 50 per cent. more than the indigenous kind, but that the yield per acre is generally larger, and that the crop matures at least a month earlier—a point of importance under the usual climatic conditons.

A four-course rotation of crops is followed at the Maigana plantation, namely, Guinea corn, millet and cowpeas; cotton; ground nuts; cotton. This scheme embraces the principal crops of the district, at the same time providing a leguminous crop in alternate seasons. The procedure in growing the mixed crop of the first year is interesting. The millet, known locally as 'gero,' is sown during the first rains, a few weeks before the Guinea corn, which is then sown in alternate rows with the millet. When the millet is harvested the soil is ridged up around the Guinea corn plants, and cowpeas are sown between the corn.

The introduction in 1914 of five sugar-cane varieties from Barbados has been very successful. Apparently the sugar cane is cultivated in Nigeria only for chewing. The natives so approve of the imported varieties that all the canes raised at Maigana were sold on the spot at a penny each, while the native canes were being sold at four for a penny.

Other economic plants successfully introduced from the West Indies and now being distributed from Maigana, are eddoes and tannias, which are much approved of by the native growers, the eddoes giving better results than the tannias, being apparently better suited to the local soil conditions.

In the more southerly plantation at Ilorin successful results have been obtained in the cultivation of tobacco, which has found a ready market locally. Samples submitted to the Imperial Institute for examination and valuation were favourably reported on. It is possible that the cultivation may be largely extended.

It would seem that cotton, the cultivation of which is usually practised in the southern districts in connexion with that of yams, is not likely to assume a position of importance there owing to climatic conditions. The cultivation of sisal is however being advocated as suitable to the agricultural conditions, and to the habits of the natives.

Kola of two species, *Cola acuminata* and *C. nitida*, has long been planted in this district, and its cultivation is systematically encouraged by the Agricultural Department, while improved methods of culture are being aimed at by instruction and practical demonstration.

Experimental plots of coco-nuts and limes promise well also at the Ilorin plantation.

Great progress has been made in horticultural work at the Kaduna station in several directions, notably in the best methods of producing European vegetables under the climatic conditions of extreme humidity alternating with extreme dryness at different periods of the year. Thus it has been proved there that potatoes, if sown between July 15 and August 15, can yield, four months after planting, at the rate of 4·86 tons per acre; and that, also in four months, Jerusalem artichokes gave the extraordinary yield of 14·4 tons per acre.

The horticultural station is also making a point of grafting and budding for distribution the choicest varieties of tropical fruit trees, especially the best kinds of citrus and mango. Experiments are also being conducted with good varieties of pine-apples, which give every promise of being a success.

It is found that for the production of really good bunches of bananas irrigation during the dry season is necessary, but if banana cultivation should prove remunerative, this could doubtless be done over large areas.

As regards insect and fungus pests Mr. Lamb reports that there have been no outbreaks of such plagues worthy of special mention during the year, and that the usual damage done by the cotton boll worm in the more humid districts could be largely prevented, were the uprooting and burning of all cotton plants at the end of February made compulsory—a conclusion perfectly in accordance with West Indian experience with regard to several pests of cotton.

PLANT DISEASES.

PROTECTING CITRUS FRUITS AGAINST ROTS IN TRANSIT.

South of Porto Rico little interest is taken in the shipping of oranges and grape fruit, save for unimportant and unorganized inter-island trade. The only citrus fruit industry of importance is the green lime trade with New York. In this case, when the fruit is well selected and packed according to approved methods, the losses from storage rots are not, so far as the writer is aware, of serious consequence. The complaints which have been made would seem to have reference to poor quality and careless packing in the shipments made by speculators during periods of heavy demand.

In Porto Rico and the Isle of Pines there is a developing trade in grape fruit, and considerable attention has to be given to prevention of losses in transit. A recent paper by J. M. Rodgers and F. S. Earle (*Phytopathology*, VII, 361), who are working at San Pedro, Isle of Pines, records the discovery of a simple and effective method of protecting citrus fruits against stem-end rot. It may find an application in the British West Indies in the occasional shipments made to England, and may even come to have an interest for the green lime trade when the growing competition leads to more discrimination as to quality.

Most growers are by now acquainted, at least in theory, with the dictum that fruits for shipment should be handled as delicately as if they were eggs, but it was found at San Pedro that even this did not suffice. Fruit picked under direct supervision of careful foremen, by labourers wearing cotton gloves, placed in standard field crates, and hauled to the packing house on waggons with bolster springs, graded by experts, and every doubtful fruit rejected—conditions which would suggest the millennium to any planter of the writer's acquaintance—still showed a large amount of decay in transit.

A large proportion of the loss was found to be due to Diplodia rot starting from the stem end of fruits with no apparent injury. A Diplodia species, it may be remarked, appears to be common on ripe limes throughout these islands. It was noted that fruit which had been clipped, retaining the calyx, showed much more susceptibility than fruit which had been pulled, owing to prevention in the former case of quick drying-out of the stem cavity.

The first attempt at protecting the fruit was made with paraffin wax. The coating of the rind with this substance did not materially alter the amount of loss from rot, but it prevented the fruit from shrivelling, and made it possible to keep thin-skinned lemons in excellent condition for two or three months. The application of paraffin to the stem ends gave promising results as a measure against stem-end rot, but was not altogether satisfactory because the material did not stick well.

The next method tried was so successful that there was no necessity to seek further. It consisted in the application, to the stem end of pulled fruits, of shellac diluted to a thin consistency with alcohol. It is easily and quickly applied, sticks well, and seals the cavity perfectly. With clipped fruits the results are much less satisfactory.

The difference between pulled and clipped fruit was consistently high all through the experiments, and is in itself at least as significant as the differences obtained by coating the stem end. Incidentally it was found that washing, in running water or in a tank, so increased the amount of decay that, in the authors' words, 'the use of a soaking tank is the greatest possible folly.'

The conclusions reached may be thus set out:—

(1) That citrus fruit should be pulled, not clipped.
(2) That coating the stem cavity with shellac largely prevents stem-end rot.
(3) That coating the rind with paraffin keeps the fruit in good condition for an additional month or six weeks.
(4) That washing the fruit induces heavy losses.

W.N.

USE OF OFFAL MANURE AND DRIED BLOOD.

Offal manure from abattoirs, as is well known, is the residue that has been steamed in the digesters to remove grease, and then steam-dried (with constant stirring) in jacketed iron cylinders until it is dry, and is reduced to a fine mechanical condition. It can be dried economically so that it does not contain more than 10 to 12 per cent of water, and in this state may contain as high as 5 to 7 per cent. nitrogen, and 13 to 16 per cent. phosphoric acid.

Blood from the abattoirs, which is dried in the same way, is generally considerably higher in nitrogen, but it contains very little or no phosphoric acid. The average composition of good samples of these products is given in the *Agricultural Gazette of New South Wales* for December 1917, as follows:—

	Offal, per cent.	Dried blood, per cent.
Nitrogen	6·98	10·71
Phosphoric acid	12·87	—

From the analysis it will be seen that dried blood is a purely nitrogenous manure, whereas offal manure, though poorer in nitrogen, contains also phosphoric acid. Neither of them, therefore, is what is known as a complete manure; that is, they do not contain those elements required for plant food, namely nitrogen, phosphoric acid, and potah, in which soils are often deficient. In the case of offal manure potash salts or ashes containing potash, must be added to make it a complete manure. In the case of the dried blood manure, both phosphate and potash must be added to make it complete. Dried blood commauds the higher price per ton on account of its higher content of nitrogen, which is the most expensive of the manurial ingredients.

The following method and rate of application of these manures are given in the journal above quoted:—

METHOD OF APPLICATION.—Both offal and dried blood are best broadcasted and lightly harrowed in. This should be done before the seeds are sown so that the manure may be well mixed with the earth, and not come in contact with the seed in its raw state. For fruit trees or standing crops it can be applied at any time as a top dressing, being mixed with loam before application, or lightly harrowed in immediately after. Thorough mixing with the soil is essential, as the efficiency of the manure depends upon its fermentation. For this reason moisture is necessary.

and disappointing results are to be expected if the soil is too dry for fermentation to take place.

Where the soil is dry, it is a good plan to compost the offal and dried blood in a heap with lime and soil in alternate layers, covering the heap with soil to prevent loss of ammonia, and keeping it moist with urine, waste water from the farm, etc., which may conveniently be poured at frequent intervals through a central passage left open for the purpose. On account of the fact that fermentation is necessary in order to render the nitrogen available for the plant, these manures do not give immediate results, and some time must be allowed for them to undergo fermentation before results are to be expected.

RATE OF APPLICATION.—For land which is to carry ordinary crops, such as vegetables, fodder crops, etc., a dressing of 4 to 5 cwt. per acre of offal manure would be a fair dressing; and for fruit trees in full bearing up to twelve years old, 5 to 6 lb. of offal manure per tree. Somewhat larger quantities should be used for older trees.

In the case of dried blood, about half the above quantity will provide the same amount of nitrogen.

Offal manure, blood and bone dried manure, and dried blood are all suitable for use on any class of soil and for any kind of crop. They have the advantage over chemical manures containing nitrogen and phosphoic acid, such as sulphate of ammonia and superphosphate, that they contain organic matter in addition, which produces humus—an extremly valuable soil constituent. They have the disadvantage however that, even under favourable conditions, they are slow in their action; at the same time, this disadvantage is compensated for to some extent by the fact that their beneficial action is more lasting, and that they are not so liable to be leached out.

Mr. F. B. Guthrie, the writer of the article from which the above is abstracted, emphasizes two points to which attention has been previously drawn, and which must not be lost sight of: (1) that neither offal not dried blood is a complete manure, and (2) that good results are not to be excepted if the soil is too dry. Failure to realize these facts may result in disappointment.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market for the month of January 1918:—

The report of the condition of the drug and spice markets for the first month of 1918, differs but very little from what has prevailed during the preceding twelve months. The tonnage question is one that affects all oversea products alike, whether it be for food, medicine or manufactures, and the consequent reduction in imports automatically causes increase in the prices demanded, so that buyers are still depending on the lowest limitation of purchases to meet current demands. The following are some of the principal items of interest:—

GINGER.

There has been but a very quiet demand for this article. At auction on the 24th of the month the offerings consisted of 446 bales of Cochin and Calicut, all of which were bought in, washed Cochin at 72*s.* per cwt.; some 180 bags of Japanese limed were also held at 54*s.* to 55*s.* A week later it was reported that some sales had been made of good common Jamaica at 85*s.* to 92*s.* 6*d.* Some medium to good also found purchasers at 100*s.* to 105*s.*, and washed Cochin at 70*s.*

NUTMEGS AND MACE.

Nutmegs were in good supply at auction on the 10th when some 392 packages were offered and sold at an advance of 2*d.* per lb. on previous rates. Again on the 24th of the month some 60 packages of West Indian, and 27 of Singapore were brought forward and disposed of at steady rates. At the first sale on the 10th of the month as many as 1,046 packages of mace were brought forward, and sold at a decline of from 3*d.* to 8*d.* per lb. on previous prices. Again at auction on the 24th of the month there was a steady demand for mace; 35 packages of West Indian were sold at the following rates: for bold flat pale 4*s.* 6*d.*, good pale 3*s.* 7*d.*, for fair 3*s.* 1*d.* to 3*s.* 4*d.*, and for fair common to ordinary 2*s.* 9*d.* to 3*s.*

SARSAPARILLA.

At auction on the 19th of the month sarsaparilla was in fair supply, being represented by 39 bales of grey Jamaica, 14 of native Jamaica, and 6 of Lima-Jamaica. Two bales only of the grey Jamaica were disposed of at 3*s.* 9*d.* per lb. for fair grey. The 14 bales of native Jamaica were all sold, 12 of them fetching 2*s.* 3*d.* per lb. for ordinary red and yellow. Of the 6 bales of Lima-Jamaica offered, only 1 was disposed of at 3*s.* 6*d.* per lb. for part mouldy.

CITRIC ACID, ARROWROOT, KOLA, CASSIA FISTULA, TAMARINDS, and PIMENTO.

At the beginning of the month the quotation for citric acid was from 3*s.* 1*d.* to 3*s.* 2*d.* per lb., which was a slight decline on the price of the previous month. Later in the month, however, the quotations rose to 3*s.* 2*d.* to 3*s.* 2½*d.* At the beginning of the month good manufacturing St. Vincent arrowroot was quoted at 7*s.* ¼*d.* per lb. Three weeks later it was reported that a considerable amount of business had been done at prices varying from 6¾*d.* to 8¼*d.* per lb. At auction on the 10th of the month kola was represented by 24 bags of dried West Indian, which were sold at prices varying from 7*d.* to 9¼*d.* per lb. Again at auction on the 16th some 68 packages of kola were offered, and all disposed of. Forty-five packages of West Indian, chiefly from Jamaica, realized from 8¾*d.* to 9¼*d.* per lb. for fair to bold, while 7*d.* to 8*d.* was paid for part mouldy. Some 18 bags of Java were also disposed of at this auction, fair to good bright halves fetching from 8½*d.* to 9*d.*; small halves realized 7¾*d.*, and part wormy 6½*d.* per lb. At the auction on the 17th Cassia Fistula was represented by 13 packages, only 9 of which found buyers. For 7 bags of wormy dry pods from Dominica 70*s.* was paid, while 78*s.* was paid for fair bold fresh pods. At the beginning of the month it was reported that a fair amount of business had been done in West Indian tamarinds at 47*s.* 6*d.* in bond. Of pimento 200 bags were offered at the last auction of the month, all of which were bought in at 4½*d.* In connexion with pimento the *Chemist and Druggist* has the following note on Pimento Oil: 'Stocks of the usual West Indian distilled oil as imported appears to have disappeared off the market, and recourse has to be had to English distilled, which is worth about 15*s.* per lb. There is a stock of over 40,000 bags of pimento in London, enough for five years' consumption, while the export is prohibited.'

MARKET REPORTS.

London.—The West India Committee Circular, February 7.

Arrowroot—No quotations.
Balata—Venezuelan Block, 3/4 to 3/7; Sheet, 3/10 to 4/-.
Beeswax—No quotations.
Cacao—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, 92/6 to 115/- per cwt.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 2/- to 3/.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—4*d*.
Rubber—Para, fine hard, 2 7½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., February 27.

Cacao—Venezuelan, $13·35 to $13·60 Trinidad, $13·25 to $13·75.
Coco-nut Oil—$1·36 per gallon.
Coffee—Venezuelan, 11c. to 12c. per lb.
Copra—$8·00 per 100 lb.
Dhal—$14·25 to $14·40.
Onions—$8·00 per 100 lb.
Peas, Split—$12·00 to $12·50 per bag.
Potatoes—English, $3·85 per 100 lb.
Rice—Yellow, $12·00 to $12·25; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., March 6.

Cacao—Caracas, 14c. to 14½c.; Grenada, 14c. to 14½c.; Trinidad, 14½c.; Jamaica, 12¾c.
Coco-nuts—Jamaica selects, $48·00 to $50·00; Trinidad selects, $43·00 to $48·00; culls, $22·00 to $25·00 per M.
Coffee—Jamaica, 9¾c. to 12c. per lb.
Ginger—15¼c. to 20c. per lb.
Goat Skins—Jamaica, 70c. to 75c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 70c. to 75c. per lb.
Grape Fruit—Jamaica, $2·25 to $2·50 per box.
Limes—$7·00 per brl.
Mace—35c. to 40c. per lb.
Nutmegs—24c.
Oranges—$6·00.
Pimento—6c. per lb.
Sugar—Centrifugals, 96°, 6·005c; Muscovados, 89°, 5·005c. Molasses, 89°, 4·948c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., March 4.

Arrowroot—$10·00 per 100 lb.
Cacao—$12·50 per 100 lb.
Coco-nuts—$24·60 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $4.75.

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A FORTNIGHTLY REVIEW

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Experiment Stations.

IN the editorial of the last issue of this Journal it was pointed out that botanic gardens had their origin in remote ages. Experiment stations, on the other hand, have only come into prominence in quite recent times as indispensable instruments in the scientific study of the principles which underlie the cultivation of all crops, and the problems connected therewith.

The oldest of such experiment stations, in the sense just stated, is that of Rothamsted in England, which was started by a private land-owner about the year 1840 for the investigation of all sorts of questions connected with farming and for elucidating the principles upon which the practice of sound agriculture might be established. It is hardly too much to say that Rothamsted has been the model on which the present system of experiment stations has been formed. In the latter half of the last century the institution of departments of agriculture in most of the civilized countries of the world led to the almost universal establishment of experiment stations in connexion with these departments. In this development the United States of America have been foremost. Every State in the Union has its experiment stations, generously supported from public funds, which, as a result of their investigations, supply an amount of practical information to agriculturists, the value of which can hardly be overestimated. It will be remembered that when the Imperial Department of Agriculture for the West Indies was created to deal with the problems connected with agriculture in these islands, and to further its interests, experiment stations were at once established in every island.

Now in these islands, as elsewhere, the planter or farmer is a notoriously conservative person. Experiment stations are conducted in reality with a view to the benefit of the planter or the farmer, but the results obtained on them, and the advice based on these results, often run contrary to ordinarily accepted practices and cherished prejudices. If a long-established agricultural practice is demonstrated sound, it is the business of the experiment station workers to explain the principles on which it rests, and to establish it on a basis of definite knowledge. If, on the other hand a practice is unsound or wasteful, it is the function of the experiment station to expose its unsoundness or wastefulness. No such maxim as this, for instance "Oh, it has worked very well for a number of

years', or 'It was the way in which my father and my grandfather worked his land; and what was good enough for them is good enough for me', should be acquiesced in, unless proof can be adduced that it is the best possible practice under the circumstances. It seems necessary, therefore, for the benefit of the agriculturist, that experiment stations should undertake very largely the work of the dissemination of general information in at least two ways: (1) by practical demonstration of improvements in the field, and (2) by publishing from time to time in popular language the results obtained by scientific experiments, and the conclusions drawn from them. For in order that the planter or farmer may understand the results of investigations it is necessary to explain in a somewhat systematic way what research has ascertained, and to show the benefit of such results in practice on the land. In this way too the interest and sympathy of the agricultural body are secured, without which the work of an experiment station is not attaining the end for which it was designed.

Here again the experiment stations of the United States set an example. The thoroughness which they have displayed in efforts to interest and benefit the farmer, and the whole-hearted co-operation of the latter with the station workers, is most admirable. In the work of the experiment stations in the West Indies, in their more limited way, the same lines have been followed, and it is gratifying to note that planters of all classes, large and small, are coming to take more and more an interest in this work, and to regard its results with appreciation and respect.

Unfortunately, the fact that much time and energy have to be expended in the two directions mentioned above has its danger, especially in these islands, where the staff of experiment station workers is mostly of necessity small, and quite inadequate ideally. The tendency is to look upon the station as a sort of model plantation on a small scale, and to consider that the chief function of the staff in charge is to give personal advice to every individual planter how to cultivate his estate. Where agricultural instructors can be appointed in connexion with the agricultural departments, the latter is their function, but the real work of an experiment station is to experiment in all directions in questions relating to agriculture.

It may seem a strange thing to enunciate, but it is true, that in experimentation just as much is learnt from failures as from successes. For the ordinary planter, who must make his land pay, often repeated failure in new crops is disheartening, if not ruinous. He cannot afford to vary his experiments over a long period of time, so as to locate the cause of failure. Here comes in the experiment station, which ought never simply to be regarded as a model paying plantation. Experiments, carefully controlled, on soils, manures, crops, can be conducted there for a series of years, with necessary or appropriate variations, and then the results can be stated with such a reasonable amount of certainty that planters may themselves avoid the failures, or copy the successes.

The field of experimentation is a very wide one, and conclusions ought not hastily to be jumped at in any direction. The varying annual climatic conditions in these islands, and their influence upon various crops, especially on various varieties of the same plant, cannot be said to have been exhaustively studied. The different types of soil, and the best means of increasing its fertility in different localities, in spite of much research, still need further local experiment and investigation. The testing of introduced varieties of a crop, and of their behaviour under new conditions of soil and climate, is perhaps the most obvious and useful kind of work undertaken at experiment stations. But to obtain reliable conclusions in this kind of investigation, experiments must be carried on over a series of years, with an inevitable amount of failure. Some new varieties which promise well at first will have to be discarded as worthless in the end, while others may so improve as to be deemed fit to be recommended for cultivation on an extended scale.

Apart from the above more generally recognized lines of experiment and research, there is that of plant breeding by hybridization and selection, together with the improvement of indigenous fruits and vegetables. Good work has been done in the experiment stations of these islands in the first of these directions on cane and cotton, as is well known. Perhaps in the future something more may be done in the second.

To carry on experiments and investigations scientifically, on all or indeed any of these lines, there should be a sufficient amount of land attached to the experiment station. Again, the station worker should have his residence near to the scene of his work, for experience has shown that it is the man who lives among his plants who gets the best results. Especially is this the case in the matter of plant breeding, which of necessity has to be done chiefly in the

early morning, and the chance of a special bit of work, if not taken advantage of at once, may not happen again for months and even years. Another desideratum is an adequate staff of trained experts in different subjects. It does not conduce to efficient experimentation or the obtaining of reliable results, if the attention of the worker or a large part of his time has perforce to be divided among several duties. As was noted above, instruction and the dissemination of information are functions of the experiment station, but the instructor, even the scientific instructor, has a part to play other than that of the experimenter and research worker. An ideal experiment station staff would be a body of experts, each one conducting research on the lines of his specialty, acting in co-operation and consultation with the others, and along with them, agricultural instructors, whose business it should be to publish and explain the results obtained by the research workers, and the conclusions thereby reached.

A NEW USE OF CENTRIFUGAL FORCE IN THE SUGAR FACTORY.

Anyone familiar with sugar machinery in a modern factory is well aware that centrifugal power is used for the expulsion of the molasses from the crystallized sugar. In an article published in the *Louisiana Planter*, for February 9, 1918, Mr. George M. Newhall describes experimentation on a large scale with centrifugal power adapted to the filtration of cane juice and other products. He believes that he has developed a machine that will perform filtration more easily, more effectively, and more economically than the filter-presses at present generally used.

The centrifugal designed for the purposes of treating the juices and syrups at various points in the process of sugar making is a separator of solids according to their specific gravity. Substances lighter than the main solution are deposited near the centre of the machine, while those that are heavier are deposited against the periphery. The following experiments were made:—

(1) *On cold cane juice direct from the mill.* Twenty thousand gallons of juice, without liming, were machined to obtain a charge of cake in a 36-inch basket. The duration of the run averaged four hours. The weight of this cake (equal in compactness to filter-press cake) varied from 750 to 950 lb., with 49 to 50 per cent. moisture, and less than 1 per cent. sucrose. The bulk of it farthest from the centre of the machine resembled filter-press cake of good quality; the inner cake was quite like glazier's putty. The weight of this portion averaged about 5 per cent. of the total charge. It contained 80 per cent. of vegetable wax, according to the chemist's report. It is being further investigated. It is evident, therefore, that cold cane juice can be readily and properly filtered by centrifugals on its way to the defecators, and freed of much more solids than are generally thought to be present in it.

(2) *On hot juices from settlers and filter-presses.* This juice, gauging about 6° Beaumé, should have been in condition to pass along to the evaporators. It was however far from that, as was shown by obtaining 559lb. of good cake from a run of 3,360 gallons through the centrifugal.

(3) *On low grade molasses warmed up.* Very cold molasses was found unfit for separation into solids and liquids, but, when warmed up, the residue of black, gummy, and oily precipitate only proved the propriety of resorting to centrifugal filtration to standardize such an output.

(4) Serious trouble having arisen in getting the settlings, etc. handled in the filter-presses, the centrifugal found no difficulty at all in forming first class cake from this stuff. The centrifugal appeared to work equally well on this gummy, viscous and rather foul mixture, whether sour or sweet, thick or thin. In short the centrifugal found no difficulty in dealing with any of the sugar-house solutions, and it will probably be found a valuable manufacturing agent in the sugar-cane factory.

SUPPLIES AND RENEWALS FOR SUGAR PLANTATIONS.

The war has done the sugar industry generally a good turn in raising prices to a remunerative level; but, on the other hand, it is tending to hamper the sugar producer more and more; it may well be that the difficulties of carrying on sugar estates will be so great before long as to affect the production to a large extent. A note in the *International Sugar Journal*, November 1917, draws attention to this aspect of the question. As matters stand at present, the scarcity of shipping, the high rates of freight, the prohibition of exports of various kinds, all contribute to make it a slow and tedious task, even when it is possible at all, for sugar plantations in different parts of the world to get renewals of machinery, implements, and chemicals.

The necessity of getting licences to export goods, or even to have them manufactured in a reasonable time, is inevitable when the claims for war material are the chief matters to be considered. The result is, however, that when an order for goods has escaped the submarine menace, and arrives at its destination, a delay often of months occurs in getting the goods manufactured, and finally, even when shipment is made at length, it is quite possible that the goods may only reach the bottom of the sea, and the order has to be repeated with still further delay and risk.

The result is bound to be that some plantations will be held up for lack of supplies. Implements for field purposes, or chemicals for the factory, or spare parts for the mill or the engine may fail to turn up in time for the reaping season, and managers of estates or factories will have to makeshift with existing supplies and stock.

Such are the conditions which apply more or less to plantations receiving their working supplies from the United Kingdom. Now that the United States has also entered into the war it is more than probable that sugar estates which have been accustomed to obtain their supplies from that country will meet with the same difficulties in obtaining them.

The chief thing, however, is to win the war. All efforts must be concentrated to this one end, and the sugar industry must be prepared to suffer along with other forms of production. It must make up its mind to an increasing scarcity of supplies. Those who are wise will send their orders for supplies so much in advance that the delay even of months will not seriously affect them; they will husband what supplies they have in hand, and avoid all waste, so as to have the means to carry on their production, even if at a restricted rate, until conditions become once more normal. It must be remembered also that the end of the war will not immediately restore normal conditions.

NOTES ON CASTOR-OIL IN THE WEST INDIES.

Owing to the increased demand for the oil obtained from the seeds of the Castor-oil plant many planters are now considering the advisability of growing this crop on a commercial scale.

Experiments were carried on in Antigua for a number of years with four varieties of castor-oil, and the results indicated that the cultivation of this plant was not likely to be commercially successful, owing to the low yield obtained. As an example of the fluctuation in yield, the results of the two seasons 1910-11 and 1911-12 may be alluded to. In 1910-11 the yield from $\frac{1}{5}$ acre with four varieties planted 5 by 4 feet was at the rate of 240lb. per acre, and the young plants were severely attacked by aphis. In 1911-12 the yield was at the rate of 1,970lb per acre. It is evident that the yield obtained from this crop may be largely affected by environmental conditions, and the incidence of insect pests.

Nevertheless, further work may result in the production of types which will give better results, and a number of observations have been made by the present writer which may serve to assist those who intend to grow castor-oil.

The first step in any proposed set of experiments would be to collect as many different varieties as possible, and test them comparatively under the particular environmental conditions with which the experimenter is concerned. When work was started at the Cornell University Experiment Station in connexion with the production of new and improved varieties of Timothy grass, no less than 223 lots of seeds were tested, and these were obtained from all parts of the world. It is not perhaps generally realized that there exist in the West Indies an enormous number of morphologically different types of castor-oil, and these would probably be found to vary very widely in characters of commercial importance.

Thus in St. Vincent and Barbados, an examination of the scattered groups of plants growing near peasants' huts showed the following differences in respect of morphological character: —

(1) Types with anthocyanin colouration in stems and leaves.

(2) Types with no anthocyanin colouration in stems and leaves.

(3) Types with a waxy bloom on stems and immature fruits.

(4) Types devoid of bloom.

(5) Seeds not easily freed from husks.

(6) Seeds easily freed from husks. These types often shed the seeds on the ground, and an excessive development of this habit is to be avoided in selection work.

(7) Capsules with spines strongly developed.

(8) Capsules practically devoid of spines.

Besides these obvious differences it was also noticed that the size and colour of the seed varied greatly from plant to plant.

In connexion with the character noted above under (5), it may be stated that one of the chief obstacles met with in the Antigua experiments was that the seeds were very difficult to shell. It is quite evident, however, that the difficulty will not be a real one, provided that the right type is chosen for growing.

In the Antigua experiments spacing between the plants was 5 by 4 feet. It is most important that the effect of different spacings on yield should be carefully investigated. From some preliminary experiments in St. Vincent, the writer is inclined to think that with some types closer spacing might give better results.

At the St. Vincent Experiment Station a hybrid was made between a native type and a variety named *Ricinus Gibsoni*, obtained from Messrs. Ryder, of St. Alban's The characters of the parents and of the F_1 may be tabulated as follows: —

The F_1 generation.

Native.	R. Gibsoni.	F_1
Anthocyanin colouration weakly developed in stems and leaves.	Leaves and stems a bronzy purple, owing to strong development of anthocyanin colouration	Intermediate, but nearer to Native
Waxy bloom present on stems and immature fruits.	Waxy bloom absent.	Intermediate.
Seeds not easily freed from capsule.	Seeds very easily freed from capsule.	Intermediate.
Seeds very small.	Seeds larger.	Apparently intermediate.
Pattern of seed dark brown.	Pattern of seed paler brown	Pattern of seed dark brown, and much more strongly developed than in either parent.

The F_2 generation.

In the second hybrid generation such an enormous range of variation occurred in respect of both morphological and physiological characters that, with the limited amount of time at the writer's disposal, a detailed examination of the plants was out of the question. The only character which was carefully gone into was the inheritance of the waxy bloom, segregation of the parental types being quite well marked.

The following numbers were obtained:—

Bloom as in Native.	Bloom intermediate as in F_1	Bloom absent.
101	230	118

From these results it is probable that the presence and absence of wax in Ricinus constitute a Mendelian pair.

A general survey of the plants showed a re-appearance of all the characters of both parents, and, in addition, others not possessed by the latter. Some of the new characters appeared to be of economic value; e. g. one or two plants possessed a larger number of fruits to the spike than either parent Certain of the plants possessed the habit of shedding the whole capsule as soon as it became ripe. This character is obviously an undesirable one.

Without entering into the subject in a very detailed manner, it may be said that until exhaustive experiments on a large scale have been carried out in the West Indies, it must remain an open question as to whether the cultivation of this crop is likely to be a commercial success. At the same time the writer does not know of any institution in the West Indies which has sufficient resources at its command to carry out such a series of investigations.

S.C.H.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Reports from the Agricultural Instructors for the month of February, which have recently come to hand, indicate considerable activity over native food production work. Both officers are engaged on the native food crops campaign this year.

It has been decided by the Agricultural and Commercial Society that a Provision Gardens Competition be offered in each parish in Grenada and in Carriacou during 1918. No cacao competition has been offered this year. A Cotton Competition will be offered by the Agricultural Department in Carriacou during 1918.

Regarding the chief industries, it is stated that the cacao crop continued during the month with very big pickings and most estates are well forward up to date. The spice crop has a satisfactory appearance and prices are moving upward. The sugar crop does not show very satisfactory prospects.

In regard to peasant agriculture, praedial larceny is complained of as being on the increase. A yam (locally known as Cut-and-throw-away) was dug by a peasant at Grand Roy, weighing 53lb. and measuring 3 feet 6 inches in length. With favourable weather the planting of sweet potatoes still continues.

DOMINICA. The Curator, Mr. Joseph Jones, reports usual routine work in the Botanic Garden and Experiment Station during the month of February. Plant distribution included 2,650 limes, 150 shade trees, 100 vanilla, 142 miscellaneous. In addition, 344 packets of vegetable seeds were sold. The price paid for fresh green limes locally rose from 10*s.* to 16*s.* per barrel, whilst ripe limes remained unchanged at 6*s.* 6*d.* per barrel. The Permanent Exhibition Committee met on the 27th instant, and decided to take steps to forward to the newly formed Commercial Museum at Ottawa a collection of samples of the chief commercial products of Dominica. The weather was normal; the rainfall for the month equalled 8·73 inches.

MONTSERRAT. Plant distribution during February was as follows: bay plants, 610; cane cuttings, 7,250; sweet potato cuttings, 1,200; ground nuts, 12 lb.; and pedigree cotton seed, 540 lb. In the Botanic Gardens three distillations of bay leaves were made with the usual results. Regarding staple crops, Mr. Robson observes that good rains having recently fallen, a start will be made to plant the new cotton crop. The destruction of old plants from last crop had been carried out fairly effectively, although a number of prosecutions under the Cotton Ordinance were found necessary. It is suggested that a special instructor should be appointed each year for about six weeks to carry out the provisions of this Ordinance. The importance of the cotton industry to the small grower is evidenced by the fact that for the sale of cotton 1,043 licenses were issued in the past season. Present indications are that the area planted in cotton in 1918 will exceed that of any previous year. A shortage of vegetables is feared, as the weather in November and December prevented the planting of potatoes to any extent. Samples of cotton lint were sent to the newly formed Commercial Museum at Ottawa. The rainfall recorded at Grove Station was 6·38 inches; the distribution however was very local, and the windward district has had very little rain.

NEVIS. Mr. W. I. Howell, in his notes for the month of February, refers to the progress made by the various plots in the Experiment Station. Plant distribution included 1,000 cassava cuttings, and 6lb. of cotton seed. The cane crop throughout the island is being reaped but the returns are poor. Sugar is being made on some of the estates; the greater part of the crop, however, is being sold to the St. Kitts Factory. The old cotton bushes are being pulled up and preparation made for next season's crop. If sufficient labour can be obtained there is likely to be a fairly large increase in the acreage under cotton cultivation this season. There is a large quantity of available land for cotton growing, and advances could be obtained; the only difficulty is labour. A small area was planted in provision crops during the month but not nearly as much as ought to be put in, and every effort is being made to induce growers to plant ground provisions.

The total number of bales of cotton purchased for the Admiralty amount now to 923, weighing 297,535lb. The rainfall for the month was 3·27 inches, and for the year; 5·45 inches.

VIRGIN ISLANDS. The Curator reports plant distribution at Tortola as follows: onion seedlings, 58,600; cassava cuttings, 525; potato cuttings, 325; coco-nut plants, 12; cotton seed 10lb.; vegetable seed, 6 packets. The condition of the cotton crop, Mr. Fishlock writes, is somewhat better; the plants are recovering from the attacks of cotton worm. There will be a small cane crop. Onions are promising a good crop, but the prices in the local market are likely to be lower than last year. The weather was more favourable than in January. Rain fell in measurable quantity on nineteen days of the month, the total precipitation recorded at the Station being 2·40 inches. It is hoped, Mr. Fishlock observes, to resuscitate the Cotton Growers' Association. A meeting with this object in view was planned for March 8.

DEPARTMENT NEWS.

News has been received that Sir Francis Watts, K.C.M.G., the Imperial Commissioner of Agriculture for the West Indies, arrived in Jamaica on February 27.

Mr. H. A. Ballou, M.Sc., Entomologist on the staff of this Department, has been decorated by the Sultan of Egypt with the Order of the Nile, Third Class, in recognition of his services in the investigation of cotton pests during the past year in Egypt.

A despatch has been received from the Secretary of State for the Colonies, to the effect that Mr. Ballou left Port Said on February 18, on his return journey to the West Indies.

Mr. S. C. Harland, B. Sc., Scientific Assistant for Cotton Research, returned to St. Vincent on March 25.

According to the *Australian Sugar Journal*, November 8, 1917, Cuban sugar planters are advised to use native bat guano as a substitute for phosphate. Formerly very little was known regarding the deposits in the bat caves of Cuba, but considerable activity is now being manifested in the working of them. These caves are in the limestone hills, and for centuries have been the home of millions of bats whose excrements and bodies have left deposits consisting principally of phosphate of lime, sometimes amounting to as much as 40,000 to 50,000 tons, and probably more.

COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended March 9, 1918, is as follows:—

ISLANDS. There has been some inquiry, but only a limited demand for Fine to Fully Fine, yet notwithstanding this, Factors continue very firm in their views, refusing to make any concessions to sell. The small sales reported consisted of Fine to Fully Fine, slightly off in preparation. We can buy full quality at our quotations, and can make satisfactory shipments at prices relatively cheaper than Georgias and Floridas.

We quote, viz:—

Extra Fine	75c. to 80c = 77c. to 82c c.i.f.
Fine to Fully Fine	73c. to 73½c. = 75c. to 75½c. c.i.f.
Fine to Fully Fine, off in preparation,	70c. to 71c. = 72c. to 73c. c.i.f.
Fine to Fully Fine, stained,	65c. to 68c. = 67c. to 70c. c.i.f.

GEORGIAS AND FLORIDAS. The market in Savannah has been very quiet, with the limited offerings firmly held. During the past few weeks 300 to 400 bales have been bought on account of the Northern Mills, on a basis of average Extra Choice at 73c. These purchases were made partly in the interior markets.

The stock of the better grades, Extra Choice and Fancy, is small, especially so, Fancy, and they are held at 1c. advance over average Extra Choice. It would be difficult to fill orders satisfactorily for Fancy only.

The holders of the unsold stock still think that the cotton will be required in time, and that the spinners will pay full prices.

We quote, viz:—

Extra Choice and Fancy	74c = 76c. c.i.f.
Average Extra Choice	73c = 75c. c.i.f.
Choice	72c = 74c. c.i.f.

The exports from Savannah for the week have been, to Liverpool 50 bales, to Northern Mills 390 bales, and from Jacksonville, nil.

THE NEED FOR MORE COTTON.

An article in *The Times Trade Supplement*, February 1918, on the cotton industry, remarks that spinners and manufacturers of cotton goods regard with suspicion estimates of cotton crops. Crop estimates could be made however on a scientific basis so as to be trustworthy, and if they were so made they would have a steadying influence on the price of cotton all the year round, and would be of real benefit both to growers and consumers. The article referred to goes on to say that as far as can be ascertained, there will be enough cotton to meet all the demands of this season, and to leave a comfortable margin to be carried into the next season. For one thing, consumption is on a low scale owing to the abnormal prices; and for another, merchants are prepared to work with smaller stocks than usual.

That the supplies of the raw material are sufficient to meet the requirements of this season seem to be generally admitted. That the present supply is not within measurable distance of the needs of the not distant future seems also to be certain. When the fantastic prices which the war has brought into existence depart, the demand for cotton goods is bound to be enormously increased. One fact which the war has emphasized is that articles of clothing made of cotton are more useful than was realized before, and are comparatively cheap. It is inevitable, therefore, that when peace is declared there will be a great demand for them.

At the present time the Lancashire industry is far too dependent upon the United States for its supply of cotton. Cotton supplies have been, as we know, short for several seasons. Cotton prices have advanced to about four times as much as they were at the beginning of the war. Then there is the fact to be reckoned with that whereas seven years ago American cotton mills were only consuming 36 per cent. of the American cotton crop, last year these mills consumed 54 per cent. And the proportion is increasing year by year. The Lancashire industry has to face the prospect of the American mills consuming all the product of the American cotton fields. Hence the supreme necessity of endeavouring to secure supplies grown in the British Empire.

AVOCADO PEARS AS FOOD AND AS A SOURCE OF OIL.

In spite of the prejudice among Americans against food which they are not accustomed to eat, the avocado has made rapid strides towards popularity in the United States, as is evidenced by its increased cultivation in California and Florida. In an article by Mr. Wilson Popenoe in the *Journal of Heredity*, March 1918, on avocados as food in Guatemala, he points out that among the Guatemalan Indians the avocado replaces meat to a very great extent in the dietary of those industrious people. He calls attention to the food value of the fruit as shown by a table of analyses, by Professor Jaffa of the University of California in *Bulletin 254* of the Agricultural Experiment Station at Berkeley. The results of twenty-eight analyses of about twenty-four varieties showed that water was present in the pulp or edible portion of the fruit in percentages varying approximately from 60 to 80. Protein was present in amounts varying from 1·30 to 3·7 per cent., while the percentage of fat varied from about 10 to 30, carbohydrates being present in varying quantities from 3·69 to 16·17 per cent. Finally the amount of ash varied from ·60 to 1·93 per cent. Professor Jaffa, in his explanation of these analyses, points out that the total dry matter in the edible portion of the fruit is greater in the avocado than in any other fresh fruit, the nearest approach being the banana, which contains about 25 per cent. as compared with the average 30 per cent. of the avocado. The protein content is also high for a fresh fruit, approaching closely that of some dried fruits in common use, such as dates and raisins. Professor Jaffa says: 'so far as protein and ash in fresh fruits are concerned, the avocado stands at the head of the list, and with reference to carbohydrates, contains on an average fully 50 per cent. of that found in many other fresh fruits. These facts alone would warrant due consideration being given to the value of the avocado as a fresh fruit. The chief value of the avocado as food, however, is due to its high content of fat. This varies, as is shown by the analyses, from a minimum of 9·8 to a maximum of 29·1, with an average of 20·1.'

As to the caloric or energy-producing value of the avocado, 1 lb. of the pulp represents about 1,000 calories on an average, corresponding to about 75 per cent. of the fuel

value of the cereals, and not far from twice that for average lean meat.

Professor Jaffa says that it would appear that, as far as fruits are concerned, the avocado is in a class by itself, containing on the average a far higher caloric value than any other fresh fruit except the olive.

It must not be assumed that the avocado has a total food value greater than that of lean beef. It is only the caloric values which are compared, and much of the value of meat as a food lies not in the energy that it produces, but in its ability to build up and repair the used up tissues of the body.

The presence of such a large percentage of oil in the avocado has suggested that this fruit might yield a table or cooking oil which would be as valuable as olive oil, peanut oil, or other products of this nature. The Bureau of Chemistry of the Department of Agriculture, United States of America, has extracted from the avocado a thick white fat which strongly resembles some of the cooking fats now on the American market, and A. C. Hagemann of New York was able to extract from avocados grown in Florida a green oil very much like olive oil in character.

The extraction of oil from the avocado is a subject which may possibly receive much attention, for it is possible that the large quantities of avocados annually produced in the American tropics might be utilized for this purpose.

In comparing the possibilities of the avocado with the olive as an oil producer, Mr. Popenoe calculates that assuming that 50 per cent. of the oil in the fruit be lost in extraction, 48 gallons of oil would be the average product per acre from avocado trees, which is practically the same as the average obtained from the olive in California to-day; but, considering that the calculations are based on the percentage of oil contained in the Trapp variety of avocado, which is not quite 10, while in some other varieties it is as high as 30, there is evidently a possibility of getting more oil from avocados than from olives.

No commercial extraction of oil from the avocado has been undertaken as yet, and the calculations, though based on actual figures obtained in Florida avocado groves, and on laboratory analyses of the fruit, are not to be considered as anything more than suggestive of the possibilities of this fruit in a very important line, the production of oil.

FOOD-BORNE INFECTIONS.

An address on the above subject delivered by Dr. Edwin O. Jordan to the American Association for the Advancement of Science, at Pittsburg, in December 1917, is given at length in *Science*, January 25, 1918. Some interesting extracts from it are given below. Dr. Jordan says that not long ago the majority of attacks of gastro-intestinal disturbance, traceable to some food eaten shortly before, were declared due, to ptomaine poison, and were deemed to be sufficiently explained by this designation. It was believed, though hardly on very good evidence, that the foods responsible for the trouble had been kept too long or under improper condition, and had undergone bacterial decomposition. This decomposition was supposed to have resulted in the formation of ptomaine, a name given to certain compounds formed in the later stages of protein disintegration.

Confidence in this theory has been shaken by many facts. For one thing, ptomaines are formed in the later stages of protein decomposition, and there is little doubt that food containing ptomaines would almost invariably be condemned by the senses as nauseating and unfit for use. Perhaps the principal reason however for the decline in the belief that ptomaines have any important share in the production of food poisoning has been the discovery that in many instances the responsibility can be placed definitely upon other factors. The outbreaks of food poisoning that have been most thoroughly investigated have been found to be due, not to the use of spoiled food containing ptomaine, but either (1) to the presence of true bacterial toxins comparable to the toxins of the diphtheria and tetanus bacilli and not to be regarded as the simple product of decomposition, or (2) to infection with specific bacteria borne in or upon the implicated food.

Poisoning from bacterial products in food, when it occurs at all, seems to be due to the accidental and occasional presence of toxigenic microbes which give rise to specific toxins. Little is known about the condition under which the relatively rare toxigenic bacteria find their way into foodstuffs. All told, demonstrated instances of food poisoning due to bacterial products are not very numerous.

On the other hand, the careful investigation of food poisoning outbreaks has brought to light a very large number of instances of apparent poisoning, which are in reality due to infection with some pathogenic micro-organism.

In general micro-organisms pathogenic for man do not increase freely outside of the human body, but in many foods conditions obtain very much like those in the artificial culture media used in laboratories. There are many instances where the incriminated food when fresh gave rise to little or no injury, but after standing twenty-four hours or less, without visible signs of decomposition produced numerous cases of illness. There can be little doubt that the almost universal preference for fresh food rests on a sound physiological basis.

Thorough cooking, including adequate pasteurization of milk, is probably the best means of preventing all forms of food-borne infection.

MINERAL OIL RESOURCES IN THE BRITISH EMPIRE.

Some interesting facts about the production of mineral oil within the British Empire were given by Professor J. S. S. Brame, of the Royal Naval College, in a recent lecture before the London School of Economics. In the present circumstances such sources are specially valuable, as being less liable to interruption than those in foreign regions. By far the most important source of supply is Burma, which furnishes nearly 3 million gallons per annum. Assam and the Punjab also afford useful contributions, while among other regions may be mentioned Taranaki in New Zealand, Trinidad and Barbados, Canada, Egypt, Sarawak, and British North Borneo. In Canada the output has unfortunately diminished during recent years. Within the United Kingdom the Scottish shale-oil industry is an important asset, and further possible sources in Norfolk and elsewhere are being examined. There are vast latent possibilities in the distillation of oil from the tar fields of Athabasca, which extend over thousands of miles, and probably contain enough oil to last the world for 2,000 years. When the country is more fully developed, better transport facilities available, and the cost of extraction reduced, these deposits may prove a very valuable asset to the Empire. At present, only about 3 per cent. of the world's production of mineral oil comes from the British Colonies and Dominions.

The foregoing information is gleaned from the *Journal of the Royal Society of Arts*, February 8, 1918.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
Entomologists	H. A. Ballou, M.Sc.† J. C. Hutson, B.A., Ph.D.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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Assistant for Publications	A. B. Price, Fell. Journ. Inst.

**Seconded for Military Service.*
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

Experiment Stations, and their function in agricultural science form the subject of the editorial in this number.

The life-habits of the West Indian mole cricket are described under Insect Notes on page 106.

Under Plant Diseases will be found notices of a new bacterial disease of Citrus trees, and a new and serious disease affecting sugar-cane in Porto Rico

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Some notes on castor-oil plants in the West Indies appear on [illegible]

Coco-nut Prices and Coco-nut Butter in Dominica.

By a Proclamation published in the Dominica *Official Gazette*, March 4, 1918, the exportation from that island of coco-nuts, coco-nut plants, copra, or any product of the coco-nut is prohibited except under certain conditions.

By a notice published in the *Gazette* of March 6, the local retail market prices for mature coco-nuts have been fixed at 1½*d.* for one, or 1s. 3*d.* for a dozen small coco-nuts, and 2*d.* for one, or 1s. 9*d.* for a dozen large coco-nuts. The price per 100 is fixed at 10s., and per 1,000 at £5 12s. 6*d.* for small nuts, and at 14s. per 100, and £6 5s. per 1,000 for large ones.

Mr. Joseph Jones, the Curator of the Botanic Gardens, Dominica, in a letter dated March 16, 1918, states that coco-nut butter is being used in increasing quantities. In the country districts the parish priests are teaching the people how to make coco-nut butter on the lines of the recipe which was published in the *Agricultural News* of October 6, 1917.

Committee on the Development of the Economic Recources of St. Lucia.

The Administrator of St. Lucia has recently appointed a Committee to consider what steps can be taken by the Government further to develop existing resources of economic value, and to encourage the cultivation of products which will be of value to agriculture and to the revenue of the colony.

In a letter to the Chairman of the Committee, reproduced in the *Voice of St. Lucia*, March 2, 1918, the Administrator, after referring to the steps taken by the Government with regard to the lime industry and the drying of corn, and to the proposed establishment of a factory on co-operative lines for the extraction of coco-nut oil, goes on to say that limes, corn, and coco-nuts do not exhaust the list of economic products either already cultivated or capable of being developed, whether for local consumption or for export, either as raw material or in a manufactured state. He remarks in conclusion that the only sound policy is to attach the peasant to the land by providing the means whereby he can translate the fruit of his labour into money. If it is made worth his while he will stick to the land.

Sweet Potato Starch.

A letter to the *Journal of the Jamaica Agricultural Society*, January 1918, points out that the sweet potato makes a splendid starch which can be used for pretty nearly the same purposes as cassava and other starches. It makes very nice cakes, biscuits, and even bread, when mixed with wheat flour or corn meal. The writer gives the following as the process of manufacture:—

Select ripe, sound, potatoes, and wash them clean, there being no need to scrape or peel them: grate them in the same way as arrowroot or cassava is treated. Wash the grated stuff through a clean soft strainer to

the same way as the other roots, and allow to settle. The sooner the starch is taken out and dried after it settles, the better its colour.

'The refuse left in the strainer, mixed with wheat flour or corn meal, can be made into puddings or dumplings.'

Pedigreed Seed.

Much interest in this subject is being evinced in Canada, as shown by various articles in the *Agricultural Gazette of Canada*, February 1918.

The outstanding requirement in good seed is that it be able to reproduce plants with desirable characters. In speaking of pedigreed seed we might define it as that grown from plants with a known record, and strictly speaking, that definition is correct. In seed, as in live stock, the ruling principle is that like tends to produce like, as a result of which it is of the greatest importance that the seed or the animal used for propagation of its kind should be of the best quality and breeding. Two methods are used in this direction: hybridization followed by selection, and selection alone. In every case where selection has been consistently applied to plants grown in cultivation, its value has been proved in maintaining the purity and vigour of the type.

The Relation of Flowering to Crop on Lime Estates.

Mr. Joseph Jones, the Curator of the Botanic Garden in Dominica, sends the following interesting note on the above subject:—

'Recently, lime trees have flowered abundantly, which is taken by many to indicate an excellent coming crop. But lime trees always flower sufficiently to bear excellent crops, as successive flushes of flowers occur between January and June. The dominating factor in crop production is the presence in the soil of the necessary plant foods in sufficient quantities to enable a good crop to be borne. The well-grown trees, with their dark-green foliage, which are seen on the best lands, although they flower well, never make a conspicuous show such as is seen on thin-foliaged trees growing on soils which, owing to poor husbandry, are deficient in the elements necessary for healthy and productive plant life. The latter trees in what is called a good season are almost white with flowers; yet this is nothing but an outward sign of poverty, and a visible assurance that a good crop cannot be carried owing to lack of vigour caused by want of plant food. Estimates of coming crops on the mere evidence of flowers should never be made. It would be better to base estimates on the amount spent in draining and in fertilizing the fields. There never was a tree more willing to do its work of producing fruit than the lime. If only cultivators were as willing to do their share in attending to the tree's requirements, the lime crop of Dominica would be doubled or nearly so within two years. As it is, even under the best conditions, nothing like full advantage has been or is being taken of the wonderful bearing capabilities of the lime tree.'

The Influence of Radio-Active Ore on Plants.

The question as to whether radio-activity plays any part in the growth of plants has been considerably debated, and although statements have been made as to the value of radio-active material in the soil, based mainly on the results of experiments conducted in America, the work done so far in England has not bourne out the expectation. An extensive series of trials carried out at Reading by Mr. H. F. Sutton, produced negative or contradictory results. In the report on pot-culture experiments in 1916 at the Woburn Experimental Station, Dr. Voelcker, Consulting Chemist to the Royal Agricultural Society of England, gives the result of investigations on this point carried out at Woburn.

A quantity of a radium ore from Portugal, very finely ground, was obtained, and used in the experiments. The ore was stated to be ground radio-active natural ore, and to contain ·15 per cent. of uranium oxide.

It was determined to try it in quantities equivalent to 5 cwt., 10 cwt., and 1 ton, respectively, per acre, and on a wheat crop. The experiments were in duplicate, with two untreated pots as controls, each pot containing 40lb. of soil. The ore was used intimately mixed with the top 20lb. of soil.

There was nothing to be noted in regard to germination, the several treated pots and the untreated all doing much about the same. During the period of growth also, the untreated set looked quite as well as any of the others. The crop was harvested five months after sowing, the result being that the untreated pots gave a somewhat superior return both of corn and straw compared with any of the treated pots. It would not appear therefore, from this experiment, that there was any advantage whatever accruing in the case of wheat from the application of radio-active ore.

The Effect of Light in Healing Tree Wounds.

Experiments have been made in the Dutch East Indies on four-year-old rubber trees of equal dimensions, to prove the influence of light with regard to the healing of wounds of the bark. A note on the subject in the *India Rubber World*, February 1, 1918, gives the following short account of the experiments and results.

From each tree a strip of bark and cambium, measuring 1 by 5 centimetres, was cut at a height of 1·5 metres from the ground, and the wound was covered, excepting a small opening at the bottom, with pieces of blue, green, yellow, red, and colourless glass. The best results were obtained with the blue and colourless glass; yellow glass gave the worst results, all the wounds under this becoming mouldy. It appeared also that wounds from which the rubber scraps had been removed healed more slowly that those in which scraps had been left, while the latter healed less rapidly than wounds covered with colourless glass, thus indicating that it is desirable to cover wounds on the trees as a healing measure.

INSECT NOTES.

THE WEST INDIAN MOLE CRICKET OR CHANGA.

An account of the West Indian mole cricket (*Scapteriscus vicinus*) has recently been issued by the Porto Rico Agricultural Experiment Station under *Bulletin No. 23* by Mr. R. H. van Zwaluwenburg. Since the above species or closely related species of mole crickets occur as pests of vegetable garden crops and of grass lawns in some of the other West Indian islands, it may be useful for readers of the *Agricultural News* to have a brief description of this insect and of some of the control measures used against it in Porto Rico.

This mole cricket is commonly known as the 'changa' in Porto Rico, a name derived, according to the writer, from the fancied resemblance of the insect's head to that of a monkey (chango). This cricket is considered to be the most serious insect pest of general agriculture in the above island, and has been the subject of investigations extending over a number of years.

DISTRIBUTION.

The writer states that the first mention of this insect as a pest appeared in 1836, in letters from A. McBarnet of St. Vincent, who described the cricket as injurious to pastures and to cane plantings. Although the pest is named only as the 'mole cricket', the insect in question is without doubt this species.

This cricket has usually been known in literature under the name of *Scapteriscus didactylus*, but *didactylus* is apparently limited in its distribution to parts of South and Central America, whereas *S. vicinus* has a wider distribution, being found in the south-eastern United States, the West Indies, and portions of South America. The present known distribution of the 'changa' (*S. vicinus*) is given as follows: Georgia, Alabama, Florida, Cuba, Haiti, Costa Rica, Panama, Porto Rico, Culebra Island (P. R.), St. Croix, St. Vincent, St. Lucia, Trinidad, Barbados, French and Dutch Guiana, Brazil, Uruguay, Argentina, and Peru.

Fig. 2. Mole Cricket
Seen from above and from the side. (*U. S. Dept. Agric.*)

HABITS.

The mole cricket is mainly an underground insect, since all its stages of development are spent in burrows, which it rarely leaves, and then generally at night. This insect is never found in heavy clay lands in Porto Rico, but in light, loamy soils, which admit of easy tunnelling, whereas the difficulties of burrowing in heavy soils would be too great. The changa usually avoids tunnelling on very sloping land, and works mostly on level areas. It was observed that this cricket is influenced by moisture changes, since in the dry season its burrows are carried to a depth of some 12 inches while during the rainy season they are to be found usually within 4 inches of the surface. In Porto Rico a prolonged drought often causes an overland migration of adults and nymphs at night to more favourable breeding and feeding grounds.

The mole cricket has its fore-feet powerfully developed and well adapted for digging, while the hard rounded shield behind the head is suitable for shaping and compressing the soil which forms the sides of the tunnel. The changa, in spite of its clumsy movements, due to the weight of its fore-legs, is a rapid runner, even over the surface of the ground, where it often increases its speed by short hops. In its underground tunnels it is able to progress very rapidly, moving forward or backward with equal ease. During the early stages this insect is very active both in jumping and running, but it was noticed that in the later stages the power of jumping is lost, and in its efforts to leap the insect often turns a somersault in mid-air.

The adult is a heavy, clumsy flier, landing heavily after a long swoop. It is not an uncommon occurrence in Porto Rico for adults to fly into lighted houses during the early evening from dusk onwards, especially on damp cloudy nights.

FEEDING HABITS AND FOOD-PLANTS.

The changa is primarily a vegetable feeder, only occasionally indulging in animal food. It remains underground and feeds from below, and almost any young plant growth is attacked. A seedling may be partially gnawed through at its base, or in the case of tender growths almost the whole sprout is pulled into the soil and eaten.

Of the crops of economic importance tobacco seems to be the one that suffers most from the changa in Porto Rico, but the use of a poisoned bait (Paris green and flour) has lessened the damage done to this crop.

Sugar-cane is attacked when planted on loose or sandy soils, the injury being confined to the germinating seed and to the bases of the young shoots, which are partially gnawed through.

Most garden crops, such as corn, tomato, cabbage, lettuce, and pepper, are severely damaged by the changa. Grasses of all kinds serve as food for this cricket, *Paspalum* sp. and *Eleusine indica* being the favourites among the common wild species. Damage is also done to the roots of any plants that happen to be encountered by this insect in the course of its tunnelling.

LIFE-HISTORY.

The life-history was worked out under laboratory conditions, but the writer is of opinion that it does not seem probable that the results so obtained differ very much from the actual life-cycle under natural conditions, except that in nature the developmental stages are probably shorter than in the insectary.

Egg. The gray, oblong-oval, shiny eggs are laid in an oval chamber about 1½ inches long, 1 inch high, and 1 inch wide. According to the observations of the writer this chamber is a blind pocket leading off from one of the galleries, and its entrance is concealed by a packing of loose earth after the eggs are laid, which serves to protect them from nymphs or adults. The eggs are dropped by the female in a loose heap. It was found that under laboratory conditions the egg stage averaged about nineteen days.

Later stages. After hatching the young changa is very active and begins feeding almost immediately. During the first few days of its life the changa exhibits a cannibalistic tendency under insectary conditions, but cannibalism is not

entirely confined to the earlier stages. The earliest hatched and stronger members of an egg cluster often feed on the weaker ones, or on some of the eggs, while the adults, both males and females, devour the eggs whenever chance offers.

This species of mole cricket usually moults eight times after the egg stage, although occasionally males are recorded as moulting only seven times before reaching the adult condition. The younger stages are somewhat similar to the adult in general appearance. The fore-legs are slender at first and the wings are undeveloped, but with each succeeding stage the nymph becomes more like the adult, the fore-legs gradually developing and growing specialized for digging, while the wings increase in size with each moult. Moulting as a rule is carried out in a specially constructed underground cell similar in shape to the egg-chamber, but it sometimes takes place above ground.

It was found that the entire period from the egg stage to the adult averaged 295 days for nineteen individuals. It is estimated that about a year is required for the full development of a generation.

ENEMIES.

No true parasites have been found to attack the changa in Porto Rico, but this insect has a number of predaceous enemies, the combined efforts of which, however, are unable to keep it under control.

The writer states that the most efficient enemies of the changa are to be found among the native birds. The two most important birds in this connexion are the Cuban green heron (*Butorides virescens cubanus*), and the Porto Rican sparrow hawk (*Falco sparverius loquacula*). Among other birds mentioned as feeding on the mole cricket in Porto Rico are the little blue heron or gaulding (*Florida coerulea coerulescens*), the tick bird or ani (*Crotophaga ani*), and the rain bird or pitirre (*Tyrannus dominicensis dominicensis*).

It may be mentioned here that in St. Lucia the West Indian mole cricket is attacked and eaten by the above species of birds or by varieties of the same species. In St. Vincent the gree-gree or chicken hawk (*Buteo antillarum*) was found by Clark to feed largely on mole crickets. This bird formerly fed mainly on lizards, but owing to the fact that the lizards have been greatly reduced in numbers by the mongoose, it seems that mole crickets have become the prey of the gree-gree.

Fowls are very useful in feeding on mole crickets where land is being cultivated, and hogs, in addition to devouring white grubs, also eat the changa.

Among other probable enemies of this mole cricket mentioned by the writer are the large burrowing lizard or 'siguana' (*Ameiva exul*), the common centipede (*Scolopendra alternans*), a predaceous carabid beetle (*Calosoma alternans*), and the larvae of the luminous elaterid beetle (*Pyrophorus luminosus*).

J.C.H.

(*To be continued.*)

STORING OF SWEET POTATOES AND OTHER VEGETABLES.

It is well known that a great difficulty in connexion with sweet potatoes as a food supply is that of storing them for any length of time. At a meeting of the Tacarigua District Agricultural Society in Trinidad on February 23, reported in the *Port-of-Spain Gazette*, February 26, Mr. A. F. Miller read a paper on the preservation of fruit and vegetables, in which he made some useful suggestions on this subject.

He said that the best way to deal with large quantities was by hilling and banking. This might be carried out under a shed, or other means could be used to prevent exposure to weather. Lay out the ground (which must be dry) with a ditch round the space required; put a good layer of straw or trash; then put the potatoes (or other roots or fruit to be preserved) in the form of a mound of triangular section; cover the whole heap with a liberal layer of straw or trash, and then cover with damp earth, packing firm with a spade. Where large quantities were stacked, a zinc pipe perforated with 1-inch holes should be placed upright through the centre of the heap thus allowing surplus moisture to escape while the potatoes were going through their sweating process. On a small scale the best way was to obtain a number of empty cement barrels, and place at the bottom of each a 3-inch layer of dry sand, then a layer of potatoes, then another layer of sand, and so on, until full, putting a layer of about 4 inches of sand on top; this would keep the tubers quite sound for six months: and only one barrel need be opened at a time. These methods were applicable to potatoes, yams, tannias and all other root crops (except cassava).

The same method might be employed in the storage of many fruits, such as mangoes and citrus fruits, as well as many kinds of other vegetables, such as cucumbers and melongenes. Such fruit for storage should be picked in a green-ripe or 'full' condition.

With regard to breadfruit and cassava, the following hints seem useful. As to breadfruit, in the Marianne Islands, the simple and effective method was used of peeling, coring, slicing, and baking the green-ripe fruit in dry ovens. These dried slices ate like biscuits and kept well. With regard to cassava, without discussing the well-known methods of starch, farine and tapioca preparation, the writer described some of the less-known ways, such as preservation for table use by slicing and sun-drying, and finally baking in ovens like breadfruit slices.

AMERICAN POTASH.

The *Journal of the Royal Society of Arts* publishes the following particulars in connexion with the potash supply in the United States of America:—

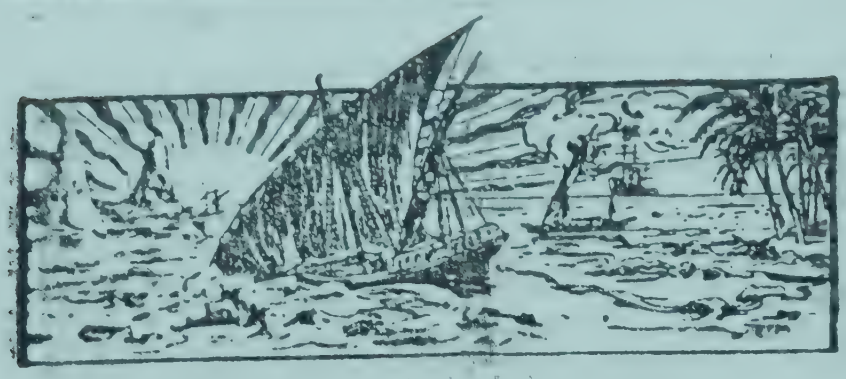
The production of potash in the United States was greatly increased in 1916, according to a report of the United States Geological Survey. The total production of potash salts and potash products in the United States in 1916 represented about 10,000 short tons of pure potash, with a net value at point of shipment of at least $3,500,000. This is ten times the value of the production reported for 1915, but the figures submitted by many of the producers represent only a start made towards the end of 1916.

The potash produced in 1916 was derived from the following sources:—

Mineral sources.—Natural salts or brines, 3,850 short tons; alunite and silicate rocks (including furnace dust recoveries), 1,900 short tons.

Organic sources.—Kelp, 1,100 short tons; pearlash (mostly from hardwood ash), 220 short tons; miscellaneous industrial waste, 1,750 short tons.

The largest output comes from the Nebraska alkali lakes, but the natural saline deposits elsewhere are beginning to make important contributions. The production of potash from organic sources is about half that from mineral sources. The recovery of potash from pearlash is an old-established industry.



GLEANINGS.

The *India Rubber World* for February 1, 1918, states that the world's total production of crude rubber of all grades is estimated at about 240,500 tons, an increase of nearly 40,000 tons on the previous crop. The rubber plantations in the Far East are responsible for about 80 per cent. of the world's total present production.

It is gratifying to learn from authoritative sources, says the Dominica *Chronicle*, March 9, 1918, that the planting of ground provisions has of late been carried out on a very appreciable scale. As one travels in the country districts numerous new provision gardens are observed on all sides, whilst many of those which were already in existence have been considerably enlarged.

As the result of a series of experiments with 'humogen' (bacterized peat) in the treatment of beans and mustard, the conclusion was reached that nitrogen, supplied in an active form like nitrate of soda, has been more effective than the same amount of nitrogen supplied in the less active form of bacterized peat. (Report on Pot Culture Experiments, 1916, Woburn Experimental Station.)

It seems that unless the seedling cane B.6450 is planted prior to the end of November, or very early in December, it will always be found very difficult to establish fields planted in this seedling. The eye of this cane is small and flat-lying, and for healthy germination requires most favourable conditions as well as very careful planting. (The Barbados *Agricultural Reporter*, March 23, 1918.)

During the year 1916, 14,772 tons of cacao were exported from Ashanti, a decrease of 3,167 tons on the previous year. This was in no way due to a decrease in the quantity produceable by the natives of the Dependency, but solely to the fall in prices, which so militated against the industry that many cultivators did not even trouble to pick their fruit, while others refused to sell at such low prices. (*Colonial Reports*—Annual, No. 949.)

The Agricultural Department, St. Lucia, published in February a leaflet on war-time recipes for using corn and corn meal, gathered from various sources in order to popularize this valuable food. In the introduction, Mr. A. J. Brooks, the Agricultural Superintendent, draws attention to the fact that a Government Granary is now being erected in Castries to handle all the corn that the island can produce, and that though the importation of corn meal from the United States is now forbidden, corn can readily be obtained from Venezuela, and the Agricultural Department is in a position to grind this corn into flour as fast as the local merchants can handle it.

Experiments have been made in the Dutch East Indies to determine the value of papain as a coagulant for Hevea latex. It is reported that a watery solution of this preparation acted twice as powerfully as acetic acid of the same concentration. Rubber prepared with papain has normal tensile strength and period of vulcanization, but it has the disadvantage that it dries with surprising slowness, and that smoked sheet worked in the usual way can under no circumstances be dried internally. (The *India Rubber World*, February 1, 1918.)

In the *Field*, February 16, 1918, there is a notice of a new vegetable gourd which might be worthy of trial in the West Indies. This is known as the wax gourd (*Benincasa cerifera*), and is cultivated in India and other warm countries as a vegetable, being used as we use the vegetable marrow. The fruit grows to a large size, between 2 and 3 feet in length, and weighing up to 6 or 8 lb. The flesh is solid, snow white, and there is little waste. The skin is covered with a white waxy substance, which is said to be used in Japan for candle making. The seeds yield an oil. The plant thrives and fruits freely under the same cultural treatment as the cucumber.

In *Colonial Reports*—Annual, No. 948, it is stated that the exuberant fertility of the soil is the principal asset of the Gold Coast. Unfortunately the ease with which valuable economic plants and trees thrive in the colony and Ashanti, with practically no attention after planting, has engendered in the native farmer a deep-seated reluctance to interfere in any way with the course of nature until the fruit is ripe for him to gather. The most difficult task of the Agricultural Department is that of persuading the cultivators, especially the cacao growers, of the importance of keeping their plantations clean, and using such simple measures of culture and sanitation as may preclude the possibility of disease spreading, and becoming a serious menace to the industry.

The Committee of the Imperial Institute for South Africa and Rhodesia reports, according to the *Rhodesia Agricultural Journal* for December 1917, that in the past much of the starch used for industrial purposes in the United Kingdom has been imported from Germany and Holland. Considerable interest therefore attaches to the possibility of increasing such starch from British territories overseas, and one of the most promising sources of supply is cassava, which is widely grown in British tropical colonies. A sample of cassava starch recently received at the Imperial Institute from Rhodesia was found on examination to represent a fairly good quality of starch, which should find a ready market in the United Kingdom, if offered in commercial quantities.

From the *Inventory of Seeds and Plants Imported* by the Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, United States Department of Agriculture, which was issued September 15, 1917, it appears that the discovery of a new oil plant seems to have been made in a creeping plant (*Plukenetia conophora*) belonging to the Euphorbiaceae, which grows in Kamerun, West Africa, in the fields among maize, and can be obtained in great quantity. It bears a thin-shelled nut about the size of a walnut, containing an oily kernel loose in the shell. It is reported that these nuts contain 53·8 per cent. of an oil which is used by the natives for cooking, but which might be a valuable substitute for linseed oil, to which it is very similar.

THE GUINEA FOWL.

Farmers' Bulletin 858, of the United States Department of Agriculture, comprises an instructive account of the guinea fowl, by Andrew S. Weiant, Scientific Assistant in Poultry Investigations, Animal Husbandry Division, from which the following notes are summarized as being of interest to poultry keepers in the West Indies.

Several species of wild birds, known as guinea fowl, are found in Africa, and derive their name from Guinea, which is situated on the West Coast of that Continent. From one of these wild species (*Numida meleagris*) the common domesticated guinea fowls are descended. They have long been domesticated, having been raised as table birds by the ancient Greeks and Romans. In Africa, where there are still many wild flocks, they are highly prized by hunters of game birds, and in England they are sometimes used to stock game preserves. In the United States guinea fowl are also growing in favour as a substitute for game birds, with the result that guinea fowl raising is becoming more profitable.

Domesticated guinea fowls are of three varieties—Pearl, White, and Lavender. The pearl is by far the most popular. It has a purplish-gray plumage, regularly dotted or 'pearled' with white, and is so handsome that frequently the feathers are used for ornamental purposes. The white guinea fowl is of pure-white plumage, and the skin is somewhat lighter in colour than in the pearl variety. Lavender guinea fowl resemble those of the pearl variety except that the plumage is of a light gray or lavender, regularly dotted with white instead of a dark or purplish-gray dotted with white. By crossing the pearl or lavender varieties with the white, what is known as the 'Splashed' guinea fowl is produced, the breast and flight feathers being white, and the remainder of the plumage being pearl or lavender. Crosses between guinea birds and other poultry, particularly fowls, and less commonly turkeys, are not unknown, but such birds without exception are sterile

The male and the female guinea fowl differ so little in appearance that many persons have considerable difficulty in making a distinction. Indeed it often happens that those who are inexperienced in raising these fowls will unknowingly keep all males or all females as breeding stock. Usually the males can be distinguished by their larger helmet [or 'horn' as it is commonly known in the West Indies] and wattles, and coarser head, but to be positive one should listen to the cry made by each bird. That of the female resembles 'buckwheat, buckwheat', and is decidely different from the one-syllable shriek of the male. When excited, both the male and female emit one-syllable cries, but at no time does the male imitate the cry of 'buckwheat, buckwheat'. [In the West Indies this cry is usually vocalized as 'come back, come back'.] Sex can be distinguished by this difference in the cry of the male and female when the birds are about two months old.

As regards breeding, guinea fowls in their wild state mate in pairs like most other wild birds, and this tendency prevails among domesticated guinea fowls also, provided the males and females are equal in number. As the breeding season approaches, one pair after another separates from the remainder of the flock, and ranges off in the fields in search of a suitable nesting place. Once mated in this way the male usually remains with his mate throughout the laying season, standing guard somewhere near the nest while the hen is laying, and ready to warn her of any approaching danger. It is not necessary, however, to mate them in pairs under domestic conditions to secure fertile eggs, and most breeders keep but one male for every three or four females. When mated in this way the hens are more apt to lay near home, and several usually lay in the same nest, thus making it much easier to find the nests and gather the eggs.

As profitable egg-producers guinea hens can not compete with the ordinary common fowl, but during the latter part of the spring and throughout the summer they are persistent layers. They usually begin laying in April or May. A short time before the opening of the laying period the hens with their mates begin searching for suitable nesting places among the weeds and brush along the fences and in the fields In this search the male takes as active an interest as his mate, and when a suitable location is found both help to dig out the nest and make it into a suitable shape. Each day as the hen goes to the nest to lay, the male accompanies her and remains near by until she comes off. Should anyone approach he shrieks in warning, and thus betrays the whereabouts of the nest, which might otherwise be difficult to locate. From twenty to thirty and often more eggs are laid before the guinea hen becomes broody; if not allowed to sit, she will continue to lay throughout the summer, laying from forty to sixty and in some cases 100 eggs during the season. If the hen becomes frightened by the intrusion of some enemy, or if all her eggs are removed from the nest, more than likely she will change her nesting place to a safer locality. For this reason she should not be disturbed while she is on the nest, and the eggs should not be removed without leaving a few nest eggs in their place. If a number of eggs are removed at one time half a dozen left in the nest usually are sufficient to keep the hen from seeking a new nest. If the eggs are gathered every day, two or three are usually enough to leave as nest eggs. It is unnecessary to remove the eggs with a spoon or to scrape them out with a stick, as is sometimes done to prevent the hand from coming in contact with the nest and leaving a scent. After the eggs are gathered they should be handled with as little jarring as possible, and should be set while fresh, never keeping them more than two weeks if it can be avoided.

Guinea hens usually are too wild to be set anywhere except in the nest where they have become broody, and often such a nest is unsafe. Because of these disadvantages, and the fact that guinea hens do not make the most satisfactory mothers, ordinary hens and turkeys are commonly used to hatch and rear guinea chicks, and it is thus very easy to raise a large percentage of the total number of chicks hatched, care being taken to keep them off wet grass for the first two or three weeks. Guinea fowls are fed in much the same way as chickens, but they require less feed, as they are natural rangers and can be trusted to find enough seeds of weeds and grasses, buds, insects, and green vegetable in the fields to supply much of their food.

When the guinea chicks are old enough to roost, that is between six and eight weeks, they will leave their coop and start roosting in some near-by tree or other roost that may be provided for them. If they have been raised with a hen they can be induced to follow her inside a poultry house and to roost there. It is advisable to have them become accustomed to go into a house or shed of some sort, otherwise it is almost impossible to catch them when they are wanted for the market. Guinea fowls, even after they are grown, become quite attached to the mother hen, and this attachment affords an easy method of controlling the natural wild instinct of guinea fowls, and makes raising them under domestic conditions much simpler.

PLANT DISEASES.

CITRUS BLAST.

A second important bacterial disease of citrus trees was announced two years ago as having made its appearance in California. It was found to be due to a new bacterium to which the name *Bacterium citrarefaciens*, Lee, was applied. The affection itself received the name of Citrus Blast. A descriptive account of the disease in its recent phase is given by Robert W. Hodgson, of the University of California, in the *Quarterly Bulletin of the State Plant Board of Florida*, dated January 1918, from which the following particulars are obtained.

Since the season of 1915, when it was confined to only two local areas, the disease has spread very rapidly and has now been reported from practically all parts of the citrus-producing districts of Northern and Central California. It is described as having been particularly virulent in 1917.

Infection is apparently confined to new spring growth or unseasoned wood produced the previous season, and occurs mainly at the junction of the petiole and blade of the leaf. Apparently a certain amount of infection also occurs at the tips of the very young leaves and tender shoots. Upon infection the leaf turns pale yellow, then darkens irregularly in spots, and wilts in place, where it later shrivels and dries still hanging to the shoots. Once established the disease progresses rapidly down the shoot toward the older wood. Only relatively new growth is affected, the older limbs possessing greater resistance. The young shoots are often killed back to the older wood, including a portion of the bark about the base of the shoot. At these points characteristic lesions are formed. It is not unusual to find a branch several feet long with every node affected in this manner. If the disease is virulent and conditions are favourable, as was the case last season, it may attack branches of the previous season's growth as large as $\frac{1}{2}$-inch in diameter, killing them back for a distance of several feet. The killed area about the base of the infected leaf or shoot varies considerably in size, and is ordinarily more or less irregular in shape, frequently extending some distance along the stem. In the case of younger growth girdling may occur about the point of infection with the resultant death of the shoot to this point. The rapidity with which the disease spreads is remarkable, and only a few days of the proper weather conditions are required for serious damage to appear.

The disease is only active when warm damp weather during a flush of growth supplies favourable conditions for its rapid development. In California these conditions rarely occur save in spring, and with the coming of the dry season the disease becomes quiescent. In the period which follows, the lesions often exude a pinkish resinous gum or bacterial slime, and such lesions and all the dead tissues later take on a characteristic dark-red colour. The dead twigs when dry are very hard and tough. During the healing process wound callus is developed at the infected nodes, which raises the dead lesions up in the form of scab-like masses. These are sloughed off in the course of time, leaving very characteristic scars which are visible for several years.

What would be the form and effects of the disease in a climate which permitted it a longer period af activity is at present unknown. Its effect in California is to kill back the fruiting twigs first grown and so to delay the setting of fruit until they are replaced by new growth.

Little or nothing is known as yet of effective methods of control.

THE MOTTLING DISEASE OF CANE IN PORTO RICO.

An account of this new and serious disease of sugar-cane, based on an article by Mr. John A. Stevenson in the *Louisiana Planter*, was given in this Journal (Vol. XVI, p. 286). In *Phytopathology* for December 1917, the same author gives a later and more complete description.

The information as to the geographical distribution of the disease is especially interesting, and is here quoted in full: 'The trouble first appeared in the Western end of the island, in the region between Arecibo and Aguadilla, and in the summer of 1916 was practically confined to that area. Since that time not only have its ravages continued in the original territory, but its boundaries have been extended so as to include an area extending from near Bayamon to Anasco, or approximately a quarter of the island.

'It has not been possible as yet to ascertain how long the disease had been present before the first report was received, but certainly a year, so that as near as is now known it has been active about three years.

'The trouble is as yet confined to the upper reaches of the river valleys, to small enclosed inland valleys, and particularly to fields among the foot-hills. The broad stretches of the coastal plain, but little above sea-level, are still free of disease, although they are planted to the susceptible varieties of cane, and form great continuous areas. The greatest damage has occurred in the rolling stretch of country between Arecibo and Aguadilla, a region which suffers much from drought. Cane culture has been abandoned on hundreds of acres.

'All observations show an apparent tendency of the disease to occur in upland fields. In its eastward progress it has apparently jumped from valley to valley, some distance back from the ocean, or has appeared sporadically rather than working along through the continuous coastal fields.'

It is agreed that the monetary loss already runs into hundreds of thousands of dollars. An instance is given of one Central, which in spite of 3,000 additional acres planted last year, and the purchase of some thousands of tons of cane from outside districts, dropped behind its previous year's production by more than half a million pounds of sugar. A considerable number of small planters have been completely forced out of cane growing in two years' time.

The one marked and constant symptom of the disease, and the one by which it is easily recognized, is the peculiar mottling of the leaves, consisting of innumerable white or at times yellowish spots and stripes with irregular indefinite margins. The ground colour may be normal green, but more often is yellow or yellowish green.

The mottling is apparent as soon as the leaves unfold. In the ratoons the second type of lesion, canker of the stalks, appears. At first there are linear spots somewhat sunken, and brown in colour. They soon become ashen or dull grey, and often coalesce to form continuous patches practically covering the surface between the joints, but never crossing the latter. They are quite superficial.

Not only is there a lack of juice in cankered canes, but what does occur is of such an objectionable nature that the centrals refuse to receive affected cane.

The cause of the disease remains obscure. All direct measures of control have proved useless. In rotation of crops, a practice previously unknown in Porto Rico, lies the only visible prospect of saving the sugar industry in the affected districts.

SUNLIGHT AS A FACTOR IN EVOLUTION.

A very suggestive paper on the influence of varying amounts of sunlight as a probably potent factor in the evolution of plants and animals was read by Colonel H. E. Rawson, C.B., C.E., F.L.S., at a meeting of the Royal Colonial Institute on November 20, 1917, Major Leonard Darwin, R.E., being in the chair. This paper is printed under the title, 'The Sun as Empire-builder' in the War Number of *United Empire* for January 1918.

As the Chairman of the meeting pointed out at the close of the reading, it is a well-known fact that certain plants show variations, especially in their leaf-structures, according to whether they grow in sunlight or in shade. There has, however, been no reason hitherto to believe that these variations are heritable. To gain the fullest value from any series of experiments we not only want the facts carefully recorded, but we want a true explanation of them. Before drawing any theoretical conclusion, great caution has to be exercised. It may be that under certain conditions of sunlight, certain Mendelian factors in the germ plasm are slowly killed or weakened, and thus the result might be not only that a slow change would appear in the flowers produced year after year, but that a change or mutation might also take place in succeeding generations. The chairman concluded by hoping that Colonel Rawson would associate with himself some physiological botanist in the enquiry into his experiments, which had evidently been conducted with great zeal and perseverance. He warned him, however, that he would be strictly questioned on many points, as, for example, the purity of the strain of the plants experimented with, and the controls adopted in his experiments.

Colonel Rawson exhibited a large number of examples of what he claimed as the effect of sunlight in changing the structure, as well as the colours of flowers, foliage, and other organs of plants.

Nearly all of such variations had appeared from time to time, and were known to botanists as sports, but attempts to reproduce them at will, or to account for them satisfactorily, have hitherto failed. These sports had been now, in the experiments described, reproduced at will over and over again. The method consists in removing full sun at selected intervals of daylight by erecting a screen at any convenient distance from the plant so as to secure that full sun only falls on the plant when desired, while at other times it gets all the skylight which its position will allow. Whenever a result is obtained, the conditions should be carefully noted and copied, even such trifles as the position of any stakes supporting the plant.

Colonel Rawson says that when quartered in South Africa, his attention was first drawn to this subject by noticing that the portion of a border to a flower bed of the shrub called the Kei-apple (*Aberia Caffra*), which was in shadow from an adjacent building for two hours in the morning, died, though it was in full sunlight from 9 a.m. to sunset, while the rest of the border, which got the full benefit of the morning sun, flourished luxuriantly. The same thing was observed in other gardens with the same species of plant. He began therefore to make experiments at Pretoria, and continued them in England to try to ascertain whether any other plants showed a similar sensitiveness to the direct rays of the sun.

Several garden vegetables were first tried, and the results showed that, if they were deprived of full sun in the early hours of the day, sunlight during the rest of the day was not able to make up the loss. The plants that got the morning low sun grow faster, and were stronger than those deprived of it.

These preliminary experiments led to others being made to see whether the colours of flowers were affected by screening the plants at selected intervals of daylight. It was decided to specialize on the ordinary garden nasturtiums (*Tropaeolum majus*, *tuberosum* and *minus*) on account of the remarkable results obtained from screening a clump of twelve of these plants, which had been established for some two or three years in the garden.

Within two years eleven out of the twelve plants had been transformed into a new purple variety, which was unknown at Pretoria, and the seed from them came true when the same conditions were attended to in the screening. Seed brought to England also came true, and the seeds from the twelfth plant at last also yielded to screening under an English sun. This new form, now growing freely in Colonel Rawson's garden, has doubtless given rise, he thinks, to many other forms which have appeared from time to time. With the changes of colour in the flower marked changes have occurred in the foliage. The scent also changes with the colour. A range of colour has been obtained from pure yellow to a rose-purple, and from pure orange to a chocolate-purple. Varied as the colours are, they can all be reduced by continuous screening of the plants to one or other of the two forms, pure yellow or pure orange.

It was found that the whole plant, not only the flowers and leaves, was affected by the screening, many most curious variations in structure also having been obtained. Some of these variations have been reproduced at will time after time, and after a change of colour or structure has been obtained in three successive years, a large number of seeds reproduce it without special screening. For instance, a dwarf purple form has been obtained which comes true from seed year after year, although there was no dwarf form nor purple form in these experiments when begun twelve years ago.

Colonel Rawson considers that his experiments demonstrate that with nasturtiums the yellow colour is correlated with receiving the rays of the sun at a low altitude from the horizon up to 35°, the red with a middle altitude from 35° to 55°, and the blue and purple with the sun above 55°, and he believes that this will hold good for the colouring of all flowers.

Experiments on yellow and red tomatoes seemed to show that the yield of fruit is substantially increased by attention to the shading which the plants receive from their surroundings at particular periods of daylight. Four times as much fruit was noticed on a 30-foot length of yellow tomato plants well placed for the reception of the rays of the low morning and evening sun, as on a similar length parallel to it, but shaded from these low rays.

As in the case of the Kei-apple, the consideration of which led to these experiments, Colonial Rawson found that he was able to render nasturtium plants unhealthy or to kill them altogether, or to restore the unhealthy plants to vigour by selective screening during short periods of daylight.

He affirms his belief that sunshine, shade, and darkness represent the presence and absence of factors of energy as important in the process of evolution as the presence and absence of Mendelian units in tracing heredity. He thinks that the examples of the sun's influence on plants leave no room to doubt its influence upon animals and man. He concludes by hoping that many others, especially in sunny lands, will be induced to make similar experiments for themselves and so increase our knowledge of what he styles a 'fascinating subject.'

MARKET REPORTS.

London.—The West India Committee Circular, February 7.

Arrowroot—No quotations.
Balata—Venezuelan Block, 3/4 to 3/7; Sheet, 3/10 to 4/-.
Beeswax—No quotations.
Cacao—Trinidad, no quotations. Grenada, no quotations. Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, 92/6 to 115/- per cwt.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 2/- to 3/-; concentrated, no quotations: Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—4d.
Rubber—Para, fine hard, 2/7½; fine soft, no quotations: Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., February 27.

Cacao—Venezuelan, $13·35 to $13·60 Trinidad, $13·25 to $13·75.
Coco-nut Oil—$1·36 per gallon.
Coffee—Venezuelan, 11c. to 12c. per lb.
Copra—$8·00 per 100 lb.
Dhal—$14·25 to $14·40.
Onions—$8·00 per 100 lb.
Peas, Split—$12·00 to $12·50 per bag.
Potatoes—English, $3·85 per 100 lb.
Rice—Yellow, $12·00 to $12·25; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., March 6.

Cacao—Caracas, 14c. to 14½c.; Grenada, 14c. to 14½c.; Trinidad, 14½c.; Jamaica, 11½c.
Coco-nuts—Jamaica selects, $48·00 to $50·00; Trinidad selects, $43·00 to $48·00; culls, $22·00 to $25·00 per M.
Coffee—Jamaica, 9½c. to 12c. per lb.
Ginger—15½c. to 20c. per lb.
Goat Skins—Jamaica, 70c. to 75c.; Antigua and Barbados, 70c. to $75c.; St. Thomas and St. Kitts, 70c. to 75c. per lb
Grape Fruit—Jamaica, $2·25 to $2·50 per box.
Limes—$7·00 per brl.
Mace—35c. to 40c. per lb.
Nutmegs—24c.
Oranges—$6·00.
Pimento—6c. per lb.
Sugar—Centrifugals, 96°, 6·05c; Muscovados, 89°, 5·05c. Molasses, 89°, 4·94c. all duty paid.

Barbados.—Messrs. T. S. Gateway & Co., March 4.

Arrowroot—$10·00 per 100 lb.
Cacao—$12·50 per 100 lb.
Coco-nuts—$24·00 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations: Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations: Patna, no quotations: Rangoon, no quotations.
Sugar—Dark Crystals, $4·75.

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Epidemics of Plant Pests and Diseases: Past and Present.

FROM time to time there have occurred in the past, and still do occur, severe outbreaks of pests or diseases affecting various crops in different countries. These may be so severe as to threaten to destroy completely the cultivation of a particular crop in the region affected, and, in fact, in some cases it has been necessary to substitute another crop for the one attacked.

Fortunately, in most cases measures, either prophylactic or remedial, have been possible, which have availed to control the pest or disease, so as to allow of the continuation of the cultivation of the crop with due precautions; but meanwhile disastrous consequences to planters have necessarily ensued.

One of the striking features of these epidemics is the rapidity with which they spread. To take the coffee-leaf disease as an example. Arabian coffee had been cultivated in Ceylon by the Dutch from the later years of the 17th century. Its culture had been largely extended under English rule, so that the production had reached a total of nearly 1,000,000 cwt. in 1873, representing invested capital of nearly £14,000,000. The leaf disease, caused by a fungus (*Hemileia vastatrix*), believed to be indigenous on certain native shrubs allied to coffee, was only noticed to have assumed a virulent form about 1869. From this time it rapidly spread throughout the island, and led to the abandonment of coffee cultivation on most of the plantations on such a scale that the production of coffee in Ceylon in 1895 was less than one-fourth of what it had been twelve years before. In Ceylon tea took the place of coffee as a crop: but in other places, as in Java, the struggle against the disease took the form of introducing other more resistant varieties of coffee, such as *Coffea liberica* and *C. robusta*.

This method of combating plant diseases or pests has been found effective in more than one instance. Just about the same time that the Hemileia was first noticed in Ceylon, the vine industry in France was threatened with extinction, owing to the wide-spread devastations of *Phylloxera vastatrix*, an insect which had been introduced on imported vines from America. It has been said that this insect cost France more than the huge indemnity exacted by the Germans

after the Franco-Prussian war. By using hardy American varieties of the vine as stocks, this pest has been controlled to a great extent.

In the West Indies the sugar-cane cultivation towards the end of the last century seemed doomed, owing to the wide-spread infestation of the Bourbon cane with the fungus of red rot, the so-called rind disease. Here again the substitution of canes of a more hardy type has replaced the sugar-cane cultivation in these islands on a firm basis. The strains at first available were much inferior to the Bourbon, but the widening of the area of selection by raising large numbers of seedlings has enabled types to be found which, if not equal to the Bourbon in popular estimation, at least give very satisfactory returns. Somewhat similar in effect, but differing in cause, is the destructive disease of sugar-cane known in Java as 'sereh'. Whereas in the case of the Bourbon cane the epidemic is known to have been caused by a specific fungus (*Colletotrichum falcatum*), with regard to the 'sereh' disease, in spite of most patient investigation, the actual cause still remains unknown. Though it has not been definitely proved to be infectious from cane to cane, it yet spread with great rapidity over the lowlands of Java, and, once established, persists in spite of the importation of planting material from outside its range. But the fact that such material takes a few years to become seriously infested has enabled the industry to continue on the basis of a carefully organized system, by which cuttings from canes grown in nurseries in the hills, where the disease does not occur, are used to plant the fields in the lower lands. A similar epidemic is just now causing alarm among sugar-cane growers in Porto Rico.

Some of these plant epidemics, as was noticed above, occur from the sudden multiplication of organisms previously existing in the locality. Others, however, and these perhaps the most difficult to deal with, have been carelessly introduced, and have usually become well established before the menace of their presence was realized.

A striking instance of this is the case of the gypsy moth in the New England States. This pest is a native of Europe, where, probably on account of the presence of natural enemies sufficient to keep it in check, its ravages are negligible. A distinguished entomologist at the University of Harvard had some specimens of this moth sent him from Europe. Some of the moths escaped, and could not be recaptured. In a few years time they had so multiplied that it seemed as if the larger portion of the forest trees of the neighbouring States would be destroyed by the larvae. Hundreds of thousands of dollars have been and are being spent by the Federal Government and by the Governments of the various States to control this epidemic pest, and it is only kept in check by ceaseless vigilance.

Perhaps a still more remarkable case of damage caused to forest trees by an epidemic is that of the chestnut bark disease in the eastern United States. The cultivation of chestnut trees has been carried on for centuries by the Chinese for the sake of the nuts The chestnut trees in China are attacked by a disease which is somewhat similar in appearance to the canker that occurs in Europe and America on apple trees. The Chinese, however, have never noticed it as especially harmful, nor is it conspicuous enough to have attracted the attention of travellers. This disease, now known in America as the chestnut bark disease, is caused by the fungus *Endothia parasitica*. It seems to have been unwittingly introduced into the United States somewhere about the year 1890, and to have been distributed to various points on chestnut nursery stock. The parasite found the American sweet chestnut an attractive host, and has spread and assumed a virulent character which, as far as is known, is totally unparalleled in its native habitat. The disease is now generally distributed on native chestnut trees from New Hampshire in the north to Virginia in the south. It is difficult to estimate the loss which the above epidemic has caused. In 1912 the total loss was said to be about $50,000,000. The disease has killed all the chestnut trees in the localities where it has been present long enough. No case is reported of a tree or grove once attacked having been saved by any method. No method has yet been discovered to control it. It would seem that all chestnut trees in the eastern States are doomed. Probably the chestnut forests will be to some extent re-established by the breeding and propagation of immune or resistant varieties.

Another introduced pest into the United States is the white fly (*Aleurodes citri*), which has been a menace to citrus-cultivation in Florida and California. The story of the measures taken to combat this pest was told in the *Agricultural News*, Vol. XVI, p. 383. A still more serious disease, which is threatening in an epidemic form the prosperity of the citrus industry, is the citrus canker, due to a bacterium introduced from the Far East. Here the only remedy that seems to be of avail is the drastic one of absolutely destroying by fire any trees with the least trace of the disease.

The story of the cotton boll-weevil is too well known to need repetition, and that of the pink boll-worm seems likely to achieve an equal notoriety. The warning, however, against possible careless introduction of them in chance importations of cotton seed or cotton waste is worth repeating.

From these instances it would appear that the agriculturist can never be sure that his crop is safe from ravages of epidemics, whether caused by insects, fungi, bacteria, or the still unknown and therefore most insidious infections such as that which produces the 'sereh' disease. The only plan is that of care and watchfulness—care in the cultivation of the crop, and watchfulness against the introduction of pests or infected plants. When such epidemic diseases as citrus canker and the new cane disease of Porto Rico, and such a pest as the pink boll-worm exist, comparatively speaking, in the immediate neighbourhood of these islands, the authorities are well advised to maintain the strictest plant quarantine.

The greatest difficulty in these matters lies in the impossibility, in the present state of knowledge, of prediction. No man can say, for example, whether, if citrus canker become established in these islands, it would ruin the lime industry or prove to be comparatively harmless. And, conversely, it has been demonstrated again and again that a disease or pest, so obscure in its native country as to be unknown, may in a new environment give rise to an epidemic of the worst type.

A NEW FOOD MAMMAL.

The shortage of meat, and the high price of fodder have caused a writer in the *Journal of Heredity*, August 1917, to call attention to an animal the meat of which is delicious; which eats food which has hitherto not been utilized; does not occupy land suitable for cultivation; and is easily tamed. This is the manatee of Southern Florida, scientifically named *Trichechus latirostris*. There are two other species of manatee known, besides that which inhabits Florida, namely *T. inunguis* which frequents the Atlantic shore from Mexico as far as the 20th parallel of latitude south, and *T. senegalensis* which lives along the shores of Africa and in the Indian Ocean. All three species are very similar.

The manatee, popularly called the sea cow, is a docile, easily domesticated animal, resembling a long bodied seal in appearance. The animal attains a maximum length of 15 to 18 feet, and old bulls weigh as much as $\frac{1}{2}$ or $\frac{3}{4}$-ton. These animals breed in small lagoons, and produce one or two calves at a birth, the family commonly consisting of four—the adult pair, one half-grown, and the young calf which is generally born in the autumn.

The animal is perfectly inoffensive, and unable even to resist attack. Its survival in the struggle for existence seems to be due to the fact that it stays in shallow water, where it is safe from enemies like sharks, and, being unable to go on land, it escapes falling a prey to land carnivora.

According to Dr. Alexander Graham Bell, these huge inoffensive creatures fairly swarmed in the rivers, bays, and lagoons of Florida when it was first discovered. They grazed upon the sea-weeds and water plants just as the herds of buffalo grazed on the prairies of the west. The flesh of the manatee was much prized, and its hide and oil were both valuable. It was so easily caught that, with the increase of the white population, it was threatened with extinction. A protected herd still exists in the Miami River in Florida. With suitable protection this herd would again increase, and be made into an important food supply for Florida and the world.

There is no reason to doubt that herds could be easily kept in confinement as private property in the lagoons of Florida, or in other suitable places in tropical or subtropical regions. It is to be remarked that in May 1907, a Bill was passed by the Florida Legislature imposing a fine of $500 for the killing of a manatee.

The dugong, the only other genus of the order Sirenia, besides the manatee, is an animal which is practically identical with the manatee except in a few minor anatomical differences; it inhabits almost the whole tropical region of the Old World. The dugong is considered by the Malays as royal food, and their chiefs are entitled to all that are taken.

Unlike many unfamiliar meats the flesh of the manatee is universally liked by everyone who has tasted it. It is often compared to veal cutlets, although some have likened it to lean pork or tender beef, and all agree in praising its whiteness, delicacy, and flavour. When salted it is like excellent bacon, and keeps well. The buccaneers of the 18th century were accustomed to replenish their supplies by a raid on the manatees; they held the flesh in high esteem. They also used the skins for their most strenuous work, including thole straps for their oars.

The thick layer of blubber which surrounds the entire body of the manatee furnishes an oil which is also of much value. It is said to be odourless and practically tasteless, and old writers remark that it never becomes rancid.

Because of the unusual density, shape, and size of the bones of the manatee they might be used as a substitute for ivory. They take a high polish without cracking, and have no central cavity. For this purpose, practically the entire skeleton would be available.

With the present high price of meat, the economic worth of an animal weighing perhaps $\frac{1}{2}$-ton with 85 per cent. of the weight available as saleable meat, is easily seen.

The natural food of the manatee is *Cymodocea manatorum* or manatee grass. It grows in the rivers of Florida in enormous quantities with stems often 4 feet long, lying dormant in winter, but in summer almost filling the river. Its value as forage seems to be very high on analysis, being almost that of cowpea hay. Such a plant might receive further investigation regarding the possibility of extended cultivation.

The writer concludes that the manatee can probably be easily and profitably reared in the warm shallow waters of the Southern States which are now unproductive. A manatee will apparently furnish as much meat as an ox; they will possibly increase as rapidly as cattle, can be more easily cared for, and may involve less expense. Manatee breeding as a commercial enterprise in the lakes and rivers where the climate is warm enough looks like a profitable and feasible undertaking.

SUGAR INDUSTRY.

THE SUGAR FACTORY AS A SOURCE OF SUPPLY OF ACETIC ACID AND ITS COMPOUNDS.

Notice was drawn in the *Agricultural News* of February 9, 1918, to the possible utilization of surplus megass. The following article by Mr. Frank Coxon, which appeared in the *International Sugar Journal* for February 1918, will be of interest in connexion with the subject:—

In 1913 market prices for acetic acids and its compounds were as follows: acetate of lime, £12 per ton; acetic acid, £37 per ton; acetone, £74 per ton.

Current prices to date are: acetate of lime, £40 per ton; acetic acid, £200 per ton; acetone, £200 per ton.

As in the case of most chemicals, the shutting down of Continental supplies on the outbreak of war immediately produced a scarcity, and, acetic acid being war material, high prices soon reigned; there is every indication of their present level being maintained.

The modern sugar factory of to-day possesses great potentialities in the supply of these compounds from the treatment of bagasse, either the main supply or the surplus, and two methods suggest themselves. (1) By using the bagasse as a gas-producing fuel in a standard producer generating gas for combustion under the boiler. (2) By destructive distillation of the bagasse in closed retorts.

In the first case, the generation of gas from the main bagasse supply for the boilers would appear to be less efficient than direct firing of the bagasse in the usual furnace. But the question of by-products from condensation and washing of the gas, before passing to the boilers; the elimination of excess air losses, a feature so necessary in efficient bagasse burning; and the more complete utilization of the effective heat units—all suggest that this method may have advantages worth some consideration. In any case, however, such a procedure would be carried out with surplus bagasse.

Regarding the destructive distillation of the main supply, this would produce a greater quantity of acetic compounds, but the boiler-house would require to look to other sources for its fuel supply, an impossibility in many cases unless oil is abundant, and a substantial profit shown between its cost and the sale of acetic acid, charcoal, and tarry compounds or their distillate.

In both systems the gases would go through similar processes, whereby the tarry matters, acetic vapours, and gas are separated by fractionation, the acetic vapours passing on to milk-of-lime absorbers, and ultimately being concentrated to yield 80 per cent. calcium acetate. The crude acetate would then be decomposed by one plant into crude acetic acid, and by another, as required, into acetone. Re-distillation of the crude acetic acid into anhydrous form, and the extraction of the light oils from the tars present no difficulty.

The foregoing suggestions, it will be noted, when applied to surplus bagasse are on the assumption that such a supply is available, which in a factory working on modern lines with a fairly high fibre content of the cane should by no means be considered out of reason, raw sugar factories having a still better opportunity than those turning out white plantation sugars. The recovery of these by-products in England on a small scale from a wood-working factory's waste has in very few cases, if any, resulted in other than financial success, and in a large factory, where modern chemical control exists, the chances of success are doubled, refined qualities of the materials being easily obtainable from the crude runnings.

A further point of advantage in this gas production suggestion is that since losses from excess air are eliminated, and better thermal conditions will exist in combustion, there is a greater possibility of overall efficiency in generating steam from a pound of bagasse turned into gas than if fired direct. Such a contingency would allow either more maceration water to be used, or, in the case of some factories, the possibility of conversion to gas production will eliminate the extraneous fuel bill.

It would not be a difficult matter to roughly scheme out balance sheets on either suggestion; but, of the inflated prices of to-day, whilst many may remain, others are likely to alter, and the advantage on the commercial success of the propositions would not be seen in a true light except where conditions in the factory are of the best, and at once apparent in their possibilities of giving a good start to the conversion.

The percentage of by-products recovered on 100 bagasse as fired, would be in the case of gas production 1 to 2 per cent. acetic acid, or about 3 per cent. calcium acetate. In the destructive distillation the sucrose in the bagasse converted into acid could be added direct to these figures.

SOURCES OF SUPPLY FOR VARIOUS SUGARS.

In a presidential address delivered before the Washington section of the American Chemical Society on January 10, 1918, which is reproduced in the *Louisiana Planter* for March 9, 1918, the President, Mr. C. S. Hudson, gave some interesting details as to the various sugars and their uses.

The annual consumption of sugar in the United States is approximately estimated as 4,300,000 short tons, of which amount 79 per cent. is cane sugar and 21 per cent. beet sugar. The growth of the beet-sugar production in the United States has been phenomenal. In 1888 only 2,000 tons were produced, but in 1915 the output had risen to 800,000 tons. Besides those two well-known sugars, dextrose (corn sugar) is largely produced in the United States by the acid hydrolysis of corn starch. It is employed in baking, in tanning, and, to some extent, in the manufacture of a type of vinegar.

A third sugar of commercial importance is milk sugar, which was produced in the United States from milk to the extent of about 3,500,000 lb. in 1914.

Many sugars that are of much interest to scientists, particularly chemists and bacteriologists, are almost wholly unknown to the general public, although they occur in considerable quantities as natural components of foodstuffs.

Levulose, used to some extent in medical practice, is prepared by forming from inverted cane sugar and lime the crystalline calcium levulosate, which is broken up into levulose and calcium carbonate by the use of carbon dioxide.

Raffinose, a sugar which is used in bacteriology, is contained in cotton-seed meal to the extent of nearly 8 per cent.

Maltose, a very palatable sugar, is prepared from starch by the action of malt. The field of possible uses of this sugar either in crystalline form or as a syrup is possibly large.

Mannose, a sugar of much interest to scientists, has usually been prepared from the hydrolysis of vegetable ivory, the seed of *Phytelephas macrocarpa*, a native palm of South America. Although closely related to dextrose and levulose,

the latter being the sweetest sugar known, it is surprising that perfectly pure mannose has only a slightly sweet taste followed by a distinctly bitter one.

A source of supply of the very rare trehalose, employed in bacteriological and chemical research work, has been discovered in *Selaginella lepidophylla*, a plant of the dry south western regions of the United States, obtainable in large quantities.

The sugar galactose, which is needed by scientists for the production of derivatives such as dulcite, is prepared from the hydrolysis of milk sugar. It has however been shown that a species of larch, a lumber tree of the North-western States, contains a considerable quantity of a gum that by acid hydrolysis yields galactose.

Arabinose may be prepared readily by the hydrolysis of beet pulp. This also is used by bacteriologists, but its cost has hitherto been almost prohibitive.

During the last year two new sugars have been added to the group by the work of La Forge, both of which have been found to occur in natural products. Mano-keto-heptose was found to occur free in the well-known avocado pear. Sedoheptose was found in the free state in the stone crop (*Sedum spectabile*), a European plant now domesticated all over the world.

Xylose, which was first found in the gummy portion of various woods, it is now stated can be obtained from the acid hydrolysis of corn cobs, in yields of about 10 per cent. If industrial uses could be found for xylose, either in the pure state or in the form of the syrup that results from the hydrolysis of the corn cobs, a very cheap and abundant waste product might be put to profitable use.

A POSSIBLE NEW SOURCE OF THYMOL.

Attention was drawn in several numbers of the *Agricultural News* (Vol. XVI) to experiments that are being conducted in more than one of these islands with regard to the possibility of the remunerative cultivation in the West Indies of the ajowan plant (*Carum copticum*) as a source of thymol, considering the present high price of this valuable antiseptic.

Before the war the production of thymol was practically a monopoly in the hands of Germany, where the oil was extracted from ajowan seeds imported chiefly from India. The scarcity of thymol, owing to war conditions, led to the suggestion in the *Bulletin of the Imperial Institute*, Vol. XII, No. 12, 1914, that its manufacture should be undertaken in the United Kingdom, and reference was made to a number of other plants, which yield oils containing thymol, and which might be utilized as sources of that material. Thymol is now being commercially manufactured in Great Britain, it is satisfactory to learn, from ajowan seed imported from India and Spain, and its distillation has also been undertaken in India itself.

Among the plants suggested for trial was *Ocimum viride*, a native of West Africa, very abundant in Sierra Leone, and said to occur also in the West Indies. This plant belongs to the same genus as the commonly cultivated 'pot basil' (*Ocimum basilicum*) which is often grown and used as a pot herb, and flourishes in these islands. *Ocimum viride* appears, however, to be a more vigorous grower than its congener, as it is said to reach a height of from 3 to 6 feet in its native habitat. In Sierra Leone it is known as the 'mosquito plant' on account of its supposed property of keeping off these insects. Specimens of the leaves from Sierra Leone have been examined at the Imperial Institute, and have yielded from 0·35 to 1·2 per cent. of oil containing thymol in quantities varying from 32 to 65 per cent.

According to the *Bulletin of the Imperial Institute*, Vol. XV, No. 3, 1917, seed of the plant was obtained from the Department of Agriculture, Sierra Leone, by the Imperial Institute, and distributed to Seychelles, Cyprus, and the East Africa Protectorate. The plant has grown well in Seychelles, and two samples of oil distilled locally have been forwarded to the Imperial Institute for examination.

In the cultivation experiment in Seychelles the seedlings when two months old were transplanted into good garden soil, and when eight months old the bushes were 6 feet high. When the plants were only four months old, and had just started flowering, a trial distillation was made of some of the leaves only. The yield of oil was 0·5 per cent. When the plants were eight months old a distillation was made of the shoots, that is to say, of the green portions of the stem above the part which turns brown, along with the leaves and inflorescences attached to them. The yield of oil was 0·45 per cent. of the weight of the green material, and the estimated yield per acre was about 35 lb. of oil, the yield of green material being reckoned at nearly 3½ tons from one cutting. It is however expected that five or six cuttings might be made annually.

When examined at the Imperial Institute, the oil from the leaves alone was found to contain 62 per cent. of thymol, while that from the shoots contained 52 per cent. A firm of manufacturing chemists estimated the value of the oil as approximately at from 5*s.* to 6*s.* per lb. in London.

It would appear, therefore, that the oil from *Ocimum viride* might be a useful source of thymol if it can be marketed at a suitable price, and it has been suggested that the cultivation be continued in Seychelles, and that a trial consignment of several hundredweight of the oil be forwarded to the London market.

Considering that the climatic conditions in Seychelles are very similar to those obtaining in the West Indies, a plant which flourishes there might very probably be equally suited to cultivation here. It might be advisable to make experiments in some of these islands as to whether *Ocimum viride* may not prove a remunerative crop, considering the present high price of thymol. In Montserrat, for instance, where bay oil is distilled, it might be quite feasible to combine the two crops, and make the distillation locally in the existing stills.

Among plants suggested as a source of thymol, the writer of this note has never seen suggested *Coleus amboinicus*, which is known in these islands as wild thyme. From the strong thymy odour of the leaves it would seem likely that it contains a percentage of thymol. Experiments in analysis of the leaves might be interesting work for some of our agricultural chemists. The plant is certainly quite naturalized in several of the West Indies, having been originally introduced from the East Indian Archipelago.

Storm and flood have been responsible for heavy damage of late in several sugar-cane districts. A cyclone and flood in Mackay, Queensland, in January, resulted in some 12,000 tons of sugar being lost, while the general damage in the district is put at 1½ million sterling. Then in the Beira district in Portuguese East Africa phenomenal rains have inundated many square miles of cane, and it is reported besides, that a very large quantity of bag sugar has been lost. The cane districts of Zululand also have suffered from floods. (The *International Sugar Journal*, March 1918.)

COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended March 16, 1918, is as follows:—

ISLANDS. The market has been very quiet with only limited demand for the odd bags classing Fine to Fully Fine, which are firmly held at quotations.

There has been, however, some demand for Planters' crop lots classing full Extra Fine for export, and several crops have been sold on private terms.

Factors are very firm in their views, refusing to make concessions to sell, thinking that the unsold portion of the crop will all be required, and that at prices current it is relatively cheaper than Georgias and Floridas.

We quote, viz:—

Extra Fine	75c. to 80c = 77c. to 82c c.i.f.
Fine to Fully Fine	73½c. to 74c. = 75½c. to 76c. ,,
Fine to Fully Fine, off in preparation	70c. to 71c. = 72c. to 73c. c.i.f.
Fine to Fully Fine, stained	65c. to 68c. = 67c. to 70c. ,,

GEORGIAS AND FLORIDAS. The market in Savannah is very quiet, with apparently no inquiry, and the Factors report having made no sales. The sales reported by the Exchange of 300 bales were cotton bought in the interior, or appropriated on orders by exporters out of their stocks. Notwithstanding the lack of general demand, the holders of the unsold stock are very firm in their asking prices, remaining under the impression that the cotton will be required in time on a basis of prices current.

We quote, viz:—

Fancy	74c = 76c. c.i.f.
Average Extra Choice	73c = 75c. c.i.f.
Choice	72c = 74c. c.i.f.

The exports from Savannah for the week have been, to Northern Mills 153 bales, and from Jacksonville to Northern Mills 338 bales.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and sixty-ninth meeting of the Council of the British Cotton Growing Association was held at the Offices, 15 Cross Street, Manchester, on Tuesday March 5. In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.) Mr. William Mullin occupied the Chair.

A letter which had been received from the Colonial Office with reference to the resignation of Mr. Hutton, as Chairman of the Association, was read as follows:—

'I am directed by Mr. Secretary Long to acknowledge the receipt of your letter of the 11th of February reporting the resignation by Mr. Arthur Hutton of the Chairmanship of the Council of the British Cotton Growing Association.

'2. Mr. Long has received with great regret the information that Mr. Hutton's health will not permit of his retaining his office as Chairman, and he desires me to express his deep sense of the services which Mr. Hutton has rendered for so many years in the active prosecution of pioneer work in cotton cultivation, especially in tropical Africa. He is glad to note that Mr. Hutton's connexion with the Association will not end with his resignation of the Chairmanship; and he hopes that in any future discussions which may take place, as in the past, between the Association and the Colonial Office, the benefit of Mr. Hutton's advice and experience may still be available.'

WEST AFRICA. The crop reports are not altogether satisfactory, but there is no doubt that the season is a late one, and from the reports received from the staff it is estimated that the Lagos crop will be about the same as last year, viz. 8,000 bales, and the crop in Northern Nigeria is estimated at 5,000 to 6,000 bales.

An embargo has recently been placed on shipments of cotton lint and cotton seed from West Africa; fortunately all last year's cotton crop has now been shipped, and it is hoped that the authorities will be in a position to give permission for the resumption of shipments of cotton at an early date.

COTTON-GROWING RESOURCES OF THE BRITISH EMPIRE.

The *Agricultural Journal of India*, January 1918, reprints from the *Empire Review* an article on the above subject by Mr. J. Arthur Hutton, who, as our readers are aware, has only just resigned the Chairmanship of the Council of the British Cotton Growing Association. Mr. Hutton states that during recent years it has been a matter of constant complaint with spinners that they find an evergrowing difficulty in obtaining suitable cotton for spinning yarn of good quality, and that year by year they have to pay a higher premium for the requisite quality of cotton.

The demand for finer goods, and consequently for high class cotton, will certainly grow in the future as it has done in the past, and this is a question affecting the British cotton-manufacturing industry more than that of any country. British manufacturers have been able to meet the competition of the world by devoting themselves to the production of goods of a finer quality. If ample quantities of the requisite quality of cotton are not available, the export trade will certainly be most seriously injured, with disastrous results to the whole country. On the rapid development of every district in the British Empire which is capable of growing high class cottons depends the whole future of the great British cotton industry.

Few people realize that at the present time something like 5½ million bales of cotton are produced every year in the British Empire. At the first glance this is reassuring, for we have a total production of nearly 5½ million bales, whereas the annual consumption of Lancashire is about 4 million bales. It would appear, therefore, that the Empire ought to be able to produce all the cotton required by the British manufacturers, with a fair surplus for other countries. There are, however, several factors to be taken into consideration. In the first place, India itself requires more than half of the cotton crop for use in its own mills. This therefore reduces the available quantity to 3½ million bales, which is half a million bales less than the consumption of Lancashire. We have also to consider the needs of our Allies, who use a considerable quantity of Indian cotton and nearly one-third of the Egyptian cotton. Further, probably not more than 200,000 bales of Indian cotton, which is almost entirely short staple, would be suitable to the requirements of Lancashire mills.

The question therefore is whether the resources of the Empire can be sufficiently developed to supply cotton of

suitable quality, and in sufficient quantity to satisfy the requirements of the British cotton industry. This is the problem which led to the formation of the British Cotton Growing Association. It is an immense advantage that a great deal of fundamental work in this direction has already been carried out by the Association, and they have not only proved where and how cotton can be grown, but also where it cannot be grown. Fourteen years ago the Association realized the danger of the position of the cotton industry, which is perhaps only now beginning to come home to the minds of the whole nation.

The problem the Association set out to solve was whether the Empire could produce sufficient cotton to keep British mills running full time, and so bring prosperity and happiness to the millions who depend on the cotton trade for their daily bread. Everything had to be learnt from the beginning, and, as was only to be expected, many mistakes were made, but the Council has never been afraid of owning up mistakes. As the results of the Association's work the cotton crop grown under its auspices last year was expected to amount to 100,000 bales, worth over £2,500,000. To build up an annual turnover of £2,500,000 in fourteen years is no small achievement, especially when the countless difficulties which had to be overcome are taken into consideration. It is true that 100,000 bales is a small matter in comparison with the 4,000,000 bales which are required every year by the British manufacturers. The Association, however, has made a good beginning, and has acquired experience which will be invaluable in efforts made to increase the cotton production of the Empire.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. During the month of March plant distribution comprised the following: lime plants, 1,800; vanilla, 1,600; cacao, 500; miscellaneous, 106. In addition, 296 packets of vegetable seeds, and 5,000 onion seedlings were sold. Mr. Joseph Jones, the Curator, states that there was considerable activity in the fresh lime trade, the local price of which advanced from 16*s*. to 26*s*. per bushel during the month. There is now no market for ripe limes. The rainfall for the month was 3·32 inches.

MONTSERRAT. Taking advantage of rains which fell in the early part of March, seed was sown in the cotton-breeding plot in the Experiment Station, where twenty-one types of cotton are being grown, each occupying one-sixteenth acre. Plant distribution during the month included the following: Bay plants, 480; sweet potato cuttings, 10,600; yams, 456 lb.; pigeon peas, 17½ lb.; black-eye peas, 46 packets; ground nuts, 23 lb.; and 83 corn cobs. In the Botanic Gardens seven distillations of bay leaves were made.

Referring to staple crops Mr. Robson, the Curator, states that probably one-half the cotton crop has been planted. It is the largest area ever planted so early, and is likely to exceed 3,000 acres. The total area planted last season is now shown to have been 2,608 acres, and as the total crop will be in the neighbourhood of 400,000 lb. of lint cotton, the average return of lint per acre for the island will be 150 lb., which, though slightly less than last season, is above the average for the last fourteen years.

There was a general scarcity of foodstuffs during the month, the supply of imported flour having been exhausted at one period. Considerable areas have been planted in sweet potatoes, but there will probably be a scarcity of imported foodstuffs for a few months, after which the situation will be relieved by local supplies.

Further investigations were made with a view to determining the available fibre in samples of cotton. Samples of fleshy pod and velvet beans were sent to the Government Laboratory for examination for poisonous principles. In view of the discovery of a new alkaloid in *Datura Metel*, arrangements have been made for appropriating 1½ acres to the cultivation of this plant. Observations are being made in connexion with silk-cotton trees that are now bearing pods. At the close of the month no general infestation by cotton stainers was noticed, although a few of the insects were observed. The rainfall recorded at Grove Station for the month was 3·89 inches, which fell mostly in the early part of the month; the rainfall for the year was 12·94 inches.

ANTIGUA. Mr. T. Jackson writes to say that during March the following plants were distributed: onion plants, 1,900; miscellaneous, 9; and 5 packets of miscellaneous seeds. During the month the weather continued to be dry, and vegetation throughout the island has suffered intensely. The canes that have been reaped are light in weight. Water had to be carted from the Country Pond to the Botanic Garden to keep pot plants there alive, the water main at the Garden having been shut off. Food became alarmingly scarce at one period of the month, and disturbances which culminated in a serious riot on the 9th, interfered with the routine work on estates. At the present moment, however, labour conditions appear to be again normal. To date 44,763 lb. of cotton have been taken over by the Government for the Admiralty. Nine plots at Clare Hall have been rented by the Agricultural Department for the purpose of growing ground provisions. The rainfall recorded for the month was 2·05 inches; for the year, 4·62 inches.

AGRICULTURE IN BARBADOS.

The following is reproduced from the Barbados *Agricultural Reporter*, April 6, 1918:—

The total rainfall for March is under 2 inches in the low-lying parts of the island, and between 4 and 5 inches on the higher levels. This total is about the average, and the distribution of it was by no means unsatisfactory.

This year is the ideal syrup year, but in spite of this we advocate co-operative factories as being absolutely the best system for the future of the sugar industry of the island. With the character of the cane grown in Barbados it should be possible with a factory of 4,000 or 5,000 ton capacity to recover the same high percentage of sugar content as that recovered in large modern factories. A disastrous multiplication of small factories is taking place, and there is a spirit of individualism shown when co-operation is suggested which must result in loss in machinery, in milling, and in manufacture.

The young cane crop does not seem to have suffered from the dry weather of the past fortnight. In most fields there is a healthy green appearance, and the holes are bunching satisfactorily.

The most important question at the present moment is the food supply of the island. Some Indian corn has been planted, and here and there a field of potatoes, but the dry weather has hindered planting to any extent. Some preparation is being made almost everywhere for food crops, but rain is necessary before anything further can be done.

The Governor of British Guiana has warned us that that colony will be unable to supply us with all the rice we have asked for, and the Allies cannot divert any food until their armies have been amply supplied.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* / Rev. C. H. Branch, B.A.
Entomologists	H. A. Ballou, M.Sc.† / J. C. Hutson, B.A., Ph.D.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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Typist	Miss B. Robinson.
Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial draws attention to ravages in the past and the present caused by severe epidemics of pests and diseases on various crops.

Under Insect Notes, on page 122, will be found the conclusion of the article begun in the last issue on the West Indian mole cricket or changa, with special mention of measures for its control. Another article on the same page deals with fleas and their control.

Attention is drawn in an article on page 126 to the importance of the variability of yield in fruit trees under apparently uniform conditions in comparisons made on trial plots.

The Pacaya or Salad Palm.

The young unopened inflorescences of the cabbage palm (*Oreodoxa regia*) are commonly used in the West Indian islands as a very tasty pickle prepared with vinegar. From a note by Mr. O. F. Cook, in the *Inventory of Seeds and Plants Imported* by the Office of Foreign Seed and Plant Introduction, United States Department of Agriculture, issued September 15, 1917, an account is given of a palm from Guatemala which might be usefully introduced into the West Indies. Its native name is 'pacaya', a species of Chamaedorea. It produces a large, fleshy, edible inflorescence which is used in Guatemala as a cooked vegetable, or as a salad. They are grown in some places in great abundance. Some of the palms have four, five and even six 'pacayas', as the edible male inflorescences are called. They attain a height of from 12 to 15 feet, but fruit probably from the third or fourth year after planting. Mr. Cook thinks that the palm would grow very well in sheltered situations in Southern Florida.

Sarawak Bean as a Cover Crop.

Dolichos Hoseii is given as the botanical name of a small creeping bean which is indigenous to Sarawak. This bean appears to fulfil all that is required as a cover crop in rubber plantations. It is a low-growing leguminous plant, which can be dug into the soil, and it reproduces itself in time to check the growth of weeds; it also grows readily from cuttings. The flower is yellow, and the leaf a rich light green. The roots do not seem to penetrate the ground more than 1 inch, while the plants form a thick mass about 6 inches thick on the ground. It will grow on almost any soil, but probably best on a light one. If planted 3 feet apart, in six months' time the ground should be so covered as to prevent all wash, and keep down all weeds. This plant was brought to the notice of the Department of Agriculture of the Federated Malay States by Mr. Hose, a rubber planter in Sarawak.

Comparative Value of Legumes as Green Manure.

In experiments conducted by the chemical department of the Hawaiian Agricultural Experiment Station, Honolulu, the results of which were published in February 1917, varieties of legumes were grown on two soils of different types. Three crops were grown of each of the varieties, using four pots for the trial of each variety. At maturity the plants were removed, weighed, and analysed for nitrogen. Analyses of the soil for nitrogen were made before planting and after removing the crop. The results show that a great deal of the nitrogen of the legumes had been obtained from the nitrogen of the air, and fixed by the root nodules. Comparisons were also made as to the amounts of nitrogen added to the soil by the various legumes. From the data given it appears that *Crotolaria juncea* (sunn hemp), *C. saltiana*, and *C. incana* —the latter a wild rattle-bush of the West Indies—are the legumes which most increased the nitrogen content of the soil. Seven of the legumes experimented with

occur commonly as weeds in Hawäii; of these the most important appear to be the wild rattle-pods already mentioned. These plants grow wild, and seem adapted to nearly every kind of soil and climate occurring in Hawaii. The chief objection to these wild rattle-pods is the woody character of their stems. This woody character appears however to be of advantage under Hawaiian conditions, since rapid decay is there undesirable. Of the other plants used in the experiment we may mention *Indigofera Anil*, *Phaseolus semierectus*, and *Mimosa pudica*, as also growing wild in many islands of the West Indies.

Yerba Mate.

The dried leaf of *Ilex paraguayensis* is the yerba maté (herb of the woods) which when smoked, dried, and cured is used by millions of South Americans to make an infusion which is their staple drink. A correspondent to *The Times Trade Supplement* for March 1918, gives some interesting information as to the use and value of this product. Yerba maté combines the stimulating virtues of tea and coffee without their ill effect upon the nerves. The tree grows thickly in the forests of Southern Brazil and the adjoining territories, the Paraná forest forming the chief source of the world's supply. The handsome, rather solid-looking leaves are gathered from May to August, dried on frames over fire, packed in bags, and sent to factories where they are milled and sieved, and divided into grades according to the fineness of the scraps to which the leaf is reduced. Thence they are shipped, chiefly to various countries of South America. South Brazil exported in 1915 nearly 76,000 tons of yerba maté, 58,000 tons of which went to Argentina. These wild ilex forests are accordingly a source of great profit. It seems there is some difficulty in raising plants from the seed, but successful experiments have been lately conducted in Argentina with slips; and, to the alarm of the South Brazilian exporters, the intention of developing plantations of the tree in Argentina has been announced. Brazil last year started energetic propaganda to promote the use of the leaf in other parts of the world. Of the total amount exported from Brazil in 1915 less than 1,000 tons went to any other part of the world than the countries of South America.

Forcing and Blanching of Dasheen Shoots.

Attention was drawn in the *Agricultural News*, Vol. XVI, p. 398, to this question as reported in the *Yearbook* of the United States Department of Agriculture, 1916. A pamphlet, issued by the Bureau of Plant Industry of the same Department, has recently been received at this Office, giving full directions for this purpose.

To obtain the shoots, corms—usually called in the West Indies 'heads'—weighing 2 to 3 lb. a piece are planted in a fairly warm place in very moist sand or sandy soil. A half-and-half mixture of sand and ordinary potting soil has given good results. The corms are just covered, the terminal bud being at the surface. Provision must be made for keeping the shoots in total darkness from the time they begin to grow. Water should be supplied often enough to keep the soil continually moist. A cover, practically light proof, and with sides 18 to 24 inches high, is required.

The first crop of shoots is usually ready for cutting in thirty-five to forty days after planting. The shoots are cut close to the corm, and, as far as practicable, before the leaves begin to expand. They will then usually be from 6 to 12 inches long. From six to ten cuttings can be made at intervals of ten to fourteen days, depending upon the attention paid, and the size of the corms used. After the corms become exhausted, which is indicated by the weak growth of the shoots, they are discarded. This cultivation has been successfully undertaken in Florida out of doors, but it is very essential that the shoots must not be exposed to light for any considerable length of time at any stage of their growth.

Recipes for cooking the blanched shoots were given in the *Agricultural News* already referred to. As however dasheen shoots uncooked have a somewhat acrid principle in them, they should never be tasted raw. Lemon juice in a little water has been found effective in relieving the irritation of mouth and throat when raw shoots have been carelessly bitten.

Capillary Watering of Plants.

The following note under the above head in the *Wealth of India*, December 1917, appears of interest, especially to growers of plants in plots. M. Lucien Daniel describes the effects on garden plants of continuous capillary watering in place of the intermittent watering ordinarily employed in market gardening. Vessels with a large surface filled with water are placed near the plants, and the water is conveyed to the bases of the plants by wicks of wool or cotton, which serve as siphons. The amount of water thus supplied to each plant is easily calculated, and can be readily increased or reduced by altering the number of threads. The advantages claimed for the process are economy of water, no burning of leaves even when carried out in full sunshine, no washing out of nutritive substances from the soil, and no caking of the surface. In a series of tests with lettuce, chicory, and cabbage, the capillary method produced much finer plants than other methods of watering. This method was also successfully applied to the germinating of seeds, and the subsequent watering of the seedlings, plants being thus produced more rapidly than by other methods. The author believes that it would be possible to devise simple appliances for using capillary watering on a commercial scale.

A somewhat similar practice was in use some years ago in the island of St. Croix, in the Virgin Islands of the United States, with respect to grape vines. A kerosene tin or other similar vessel had a small hole pierced near the bottom; this was placed near the base of the stem of the grape vine, and was kept continuously supplied with water. It was claimed that much heavier crops were obtained by this continuous watering than by heavier periodic waterings.

INSECT NOTES.

THE WEST INDIAN MOLE CRICKET OR CHANGA.

(*Concluded.*)

In the last issue of the *Agricultural News* some account was given of the habits, life-history and enemies of the above insect, as observed in Porto Rico. The following notes are concerned with some of the more important methods of control used against the mole cricket in that island.

Control Measures.

Control measures against the changa in Porto Rico may be divided into preventive measures and repressive measures.

PREVENTIVE MEASURES.

Among these may be mentioned the use of certain mechanical devices and repellents, and the practice of certain methods of cultivation and planting.

Mechanical devices. The writer states that it has long been the custom among tobacco growers and market gardeners in Porto Rico to wrap the roots of seedlings in the leaves of mammee (*Mammea americana*) when transplanting. Later, when mammee leaves became scarce, their place was taken by cylinders made of tin, heavy paper, or wire. These cylinders however are expensive, and those of tin and paper are found to cause unnatural rooting conditions. These devices are no longer practicable on a large scale, but a few will always be used for valuable plants.

Repellents. These include flowers of sulphur and naphthalene flakes, but neither are effective in the case of a heavy infestation of mole crickets.

Planting methods. Sugar-cane is now protected from the changa by planting in an upright or slanting position, since this pest only attacks the eyes and the bases of the young shoots. It has been found that hilling-up is sometimes useful in protecting gardens against the changa, advantage being taken of the insect's aversion to making its burrows up slopes, but this method is apparently ineffective against a heavy infestation. Clean cultivation by itself is not effective against the mole cricket, but is useful when preparing to apply a poisoned bait.

REMEDIAL MEASURES

These include ploughing, trapping of various kinds, flooding, and the use of poison baits.

Ploughing is valuable in controlling the changa, since by this method the insects in the soil are turned up and exposed to chickens, lizards, and other enemies. Further, egg-chambers are broken up and some of the eggs are exposed to the sun, and are thereby apparently prevented from hatching.

Trapping. The use of trap-lights against the changa is only practical during the period that the annual flights take place. In Porto Rico the changas fly in large numbers in October, November, and December, and most abundantly on damp, cloudy evenings. It is recommended that the trap-light be very bright, and that the pan of oil and water placed under it should be as large as possible. If only a small pan is available, it is useful to have the changas that fall outside the pan collected, since it has been found that the changas are not attracted to the light itself, but only to its vicinity. It has also been found quite unnecessary to keep the light going after 10 o'clock.

Experiments made with traps in Porto Rico by sinking wide-mouthed bottles in the earth up to the mouth were found to give no results, even when baited with corn meal.

It is stated that sacks or bags are used with good results in the Isle of Pines as traps for mole crickets. The bags are spread on the ground, examined early each morning, and the mole crickets found under them are killed.

Flooding is useful wherever the position of the fields makes water easily available. Nymphs and adults are not killed even by a complete submersion for three hours, but they usually find their way to the surface during that time, being able to float, and although active swimmers they usually fall prey to such birds as the heron.

Poison baits. These have been found to be the most successful upon small areas, such as garden plots. It is essential that the land be cleared completely of all vegetation, including even grasses, and kept clean for three or four days before spreading the bait, and the crop may be planted three to five days after the bait has been applied.

It is stated 'that the most satisfactory bait yet found is a dry mixture of 3 per cent. Paris green with cheap flour. Flour of the poorest quality, even that ruined by weevils and moths, is satisfactory for this purpose, corn meal, cotton-seed meal, and bran making good substitutes, though flour seems to be preferred by the changa. Barrett reported very satisfactory results from the use of a mixture of grass stems, molasses, and Paris green. The Paris green and phosphorus mixture used against crabs is said to be acceptable to changas as well.'

It is recommended that this mixture be applied, preferably in the late afternoon, at the rate of 30lb. to the acre, and it may be spread broadcast over the land. This method has the further advantage of killing other injurious plant-feeding insects, such as other crickets and cut worms.

The Paris green and flour mixture may also be applied in a shallow trench around the young plant at a distance of an inch or more from the main stem, or it is suggested that it may be introduced into a changa gallery where this approaches the surface.

It is advisable that fowls and domestic animals be kept from access to poisoned mixtures.

FLEAS AND THEIR CONTROL.

As Dr. Shipley has remarked, the fact, now fully established, that bubonic plague is transmitted by fleas, has taken that wingless insect out of the category of those animals which it is indelicate to discuss. A recently published pamphlet (*Farmers' Bulletin 897*, of the United States Department of Agriculture) by Mr. F. C. Bishopp, gives some information of general interest about the life-history and habits of various fleas, and the measures which should be taken to control them.

There are about 500 species of fleas known to be in existence, but the great majority of them need not concern us here, as they are parasitic on wild birds and mammals. There are, however, some half a dozen species which are of special economic importance as pests of man and certain domestic animals.

Habits. As a general rule it may be said that each host has its own particular species of flea; for instance, cats and dogs are normally infested by the cat-flea (*Ctenocephalus felis*) and the dog-flea (*Ctenocephalus canis*), but these fleas are sometimes a nuisance to man; again, the human flea (*Pulex irritans*) is for the most part confined to man, but may also be found on some of the domestic animals; further, rat fleas sometimes bite man, and if coming from plague-infested rats can thereby transmit the bubonic plague to man. The Indian rat flea (*Xenopsylla cheopis*) and the European rat flea (*Ceratophyllus fasciatus*) are the two species responsible for the spread of the plague in variou

parts of the world. The higher domestic animals, such as horses, cattle, sheep, and goats are not often annoyed by fleas, but pigs may be infested to some extent.

It has been found that fleas differ considerably in the intimacy with which they are associated with their hosts. Some species remain on their hosts practically all the time, while others are merely passing guests. For instance, the chigoe flea or 'jigger' (*Dermatophilus penetrans*) ordinarily buries itself in the skin of its host and there reaches maturity, develops its eggs, and dies. The sticktight flea or chicken flea (*Echidnophaga gallinaceus*) spends the greater part of its life attached to its host, but does not penetrate the skin of the animal. Poultry are attacked chiefly on the head, about the eyes, comb and wattles, while dogs and cats may be infested with this flea about the ears, mainly along the edges. Dog and cat fleas pass most of their adult existence on their hosts, but do not attach themselves, and feed only at intervals. The human flea spends very little time on man, the rest of its existence being passed elsewhere, mainly on the floor.

Life-history. The flea, like many other insects, passes through four distinct stages—the egg, larva, pupa, and adult. Usually the eggs are laid by the adult female flea while on the animal host, but since they are not stuck to the hair or feathers, they usually fall out in the resting place or nest of the animal. For instance, numbers of the minute, whitish eggs may sometimes be seen on mats or cushions slept on by infested cats or dogs. These eggs can easily be seen on dark-coloured cloths. The eggs are also scattered about on the floor, and the hatching larvæ or maggots feed on the dust refuse under carpets or matting, and in cracks. Fleas also breed outside where animals sleep beneath houses. During the period of growth the skin is moulted two or three times, add then the full-grown larva spins a cocoon in which it passes the pupa or resting stage.

The length of the life-cycle varies considerably with different species of fleas, and under different conditions of temperature, moisture, food, etc. Rainfall and the amount of air moisture have a great influence on flea breeding. Frequent rains and a high humidity favour the production of these insects, while a hot dry spell tends to check them. This does not mean that fleas require very moist places in which to breed, on the contrary, excessive moisture is as harmful to them as excessive dryness.

In the tropics, or under favourable summer conditions the life-cycle of the dog flea may be completed in from seventeen to thirty-seven days, while in cool weather or under unfavourable conditions the period from egg to adult may occupy considerably over a year.

The adult flea under ordinary summer conditions does not live very long without food, the life of the human flea probably averaging two months, that of the dog flea somewhat less, and that of the chicken flea still less.

(*To be continued.*)

J.C.H.

VEGETABLE OIL.

Staple supplies of food have, as we all know, been seriously affected by the war, and there have been much shifting of sources of supply and evolution of new material. One of the most striking instances of the foregoing is the supply of fat and oil. Up to the beginning of the war the use of animal fats as a foodstuff predominated, but the unprecedented demand for them for the use of millions of armed men reduced the possibility of an adequate supply for those who remained at home. As a correspondent of *The Times Trade Supplement*, March 1918, points out, efficient substitutes have been found in vegetable fats, chiefly derived from the coco-nut and oil palms growing in profusion in the tropical colonies of Great Britain and her allies. Vegetable oil-palm growing is therefore of paramount importance, for vegetable fat is a cheaper and more prolific production than animal fat.

The fact may be remembered that Germany firs embarked upon a vegetable butter industry, which before the outbreak of the war assumed such large proportions that fleets of British ships were busily engaged in transporting the raw material for vegetable oil from British and French colonies to Hamburg.

There has been a great deal of misconception in some quarters about coco-nut or oil-palm growing in the tropics. It has been thought that it does not pay, or that it takes too long to reap returns. Modern methods of cultivation have however shown the fallacy of such ideas.

By merely pursuing the policy of careful seed selection for instance, it has been proved that a modern plantation can be made to yield four or five times as much as by the old 'laissez faire' methods. It has also been pointed out that it would pay handsomely to raise cattle and hogs on these palm plantations, for the residue pulp from the nuts is a most valuable feeding stuff. On the other hand, the animals ensure an ample supply of manure for the trees, and thrive on the sandy coast land under their shade. Until the palm trees themselves attain an age at which they bear, the space between the trees may be utilized for growing catch crops, such as peanuts, which would materially lessen the cost of the upkeep of the plantation until the palms begin to bear.

Another profitable product of a coco-nut plantation is coir or the husk fibre, the employment of which is now being rapidly developed in the United States. Another apparently valuable by-product from the coco-nut is the cellular refuse which remains after the fibre has been extracted from the husk. Experiments have shown that this possesses high non-conducting properties, equal in this respect to cork dust, and it is now being used in the manufacture of material for steam pipe packing, and for the lining of refrigerating chambers. This coco-nut husk dust has the great advantage over cork of being much cheaper, and of being available in much larger quantities. This new insulating material is called 'pectine'.

The correspondent of *The Times* calculates that, whereas in the temperate zone it requires 4 acres of fairly decent land to support one cow or steer, on a palm estate in the tropics no less than two cows or five hogs could be raised on an average per acre, and that therefore, a coco-nut or oil-palm plantation ought to be, if conducted on scientific principles, an exceedingly profitably undertaking.

Coco-nut and oil palms are confined to a belt approximately within 18 degrees of latitude north and south of the equator. The cultivation of these palms may be enormously extended. It is probable, for instance, that at least 50,000,000 more palm trees could be grown on the east coast of Africa and in Madagascar. But possibly the most favourable land for increasing the cultivation of vegetable oil palms is the stretch of about 600 miles on the north-east coast of Brazil, where the nucleus of such cultivation now exists of nearly 2,000,000 coco-nut trees, and about 150,000 oil palms (*Elaeis guineensis*), which were orginally brought from the Gulf of Guinea in slave ships. Strange to say, they thrive better in Brazil than in their original home, yielding a larger fruit with a greater percentage of oil.

GLEANINGS.

The number of live stock on the farms of the United States on January 1, 1918, was estimated by the United States Department of Agriculture as 187,104,000, valued at $8,263,524,000, an increase of 6,393,000 in number compared to a year ago, and in value, of $1,527,912,000. (The *Agricultural Gazette of Canada*, March 1918.)

The Voice of St. Lucia, March 16, 1918, calls attention to the fact that the manager of the Maple Leaf Hotel in Castries has begun curing fish and meat by pickling. The sample examined was as good as the best of its kind imported. Fish, pork, and beef were in perfect condition, and, when cooked, in no way fell behind similar articles imported.

Health experts in the United States condemn the glass milk bottle as a pernicious germ carrier. Some dairies have begun to employ destructible bottles made of light cardboard coated with parafin. As these bottles are impervious both to air and light, milk can be kept fresh in them many hours longer than in glass bottles. (The *Scientific American*, Vol. XCVI, No. 11.)

Seeing that after the war there will be a serious falling off in the cotton crops of America owing, it is stated to the imperious demand for foodstuffs, it is possible that cotton growing may become as important and paying an industry in Queensland as in the United States of America. In Queensland the cotton grower happily has not to contend with destructive pests like the boll-weevil and cotton stainer. (The *Queensland Agricultural Journal*, February 1918.)

Among experiments carried out last year by Messrs. Sutton & Sons at Reading, some as to the effect of the removal of blossoms on the yield of potatoes are of special interest. From the results it appears that, in five out of seven plots experimented upon, picking of the blossoms resulted in an increased yield of tubers, and that the average increase was by no means negligible, amounting to 5 per cent. (The *International Review of the Science and Practice of Agriculture*, December 1917.)

In a note on the development of the Empire's fishing areas, in *Tropical Life* for February 1918, it is remarked that attention might be given to developing the splendid fish supplies in tropical and semi-tropical areas, where the fish obtainable are very nourishing, even if not equal to the fish obtainable from cold oceans, and extremely pleasant as food. Another point to remember is that if the fisheries of the tropics are developed, the inhabitants of those regions will need smaller supplies of meat and of foodstuffs from America and Europe.

The noted American inventor, Edison, claims that he can produce thin sheets of metal, especially of nickel, which would serve every purpose for which paper is now employed, as far as books are concerned, and that these will be cheaper, thinner, tougher, and more flexible than ordinary paper. (The *Wealth of India*, December 1917.)

The conclusions reached on the results of experiments for a period of six years on crop rotations at the University of Minnesota Agricultural Experiment Station, as recorded in *Bulletin 170*, for October 1917, is that the net income per acre from grains and corn grown in rotation with clover or similar legumes may be constantly expected to be higher than from the same crops grown continuously, or in rotations not including clover.

Considerable progress has been made in Germany and Austria in the manufacture of paper yarn. Samples of German fabrics containing these yarns have been received in England. Some of these samples have been found to consist of 40 per cent. twisted paper, 40 per cent. of cotton, and 20 per cent. of wool waste. Passable-looking suits have been made of woollen and paper yarn, alternating two by two. The fabric is certainly not improved by exposure to rain. (*The Board of Trade Journal*, February 14, 1918.)

In answer to an enquiry made by the Ceylon Agricultural Society to the Imperial Institute as to whether there was any likelihood of a demand for turmeric dye, the reply was that there is a regular demand for turmeric, partly for use as a dye, but chiefly as a spice for curries, etc. There seems no reason to anticipate any great increase in the demand. The colouring matter is not extracted by the grower, but the turmeric rhizomes themselves constitute the marketable product. (The *Tropical Agriculturist*, December 1917.)

The following recipe for making corn bread is taken from the Jamaica *Gleaner*, February 8, 1918: 'Bring 1 pint of milk to the boiling point, add three-quarters of a cup of corn meal mixed with a little cold water, and cook a few minutes, then add one tablespoonful of salt, one rounded tablespoonful of lard or butter, one quarter teaspoonful of soda, and, if liked, one half-cup of molasses. Let cool. When blood-warm add three-quarters of a yeast cake dissolved in one cup of warm water. Let this batter rise until light, then mix very stiff with white flour, and knead well. Let rise until double its bulk. Then form into loaves, and let rise to top of pan. Bake one hour.

Experiments recently published in the *Bulletin de la Société des Ingénieurs Civils de France* describe how iron plates, well cleaned and polished, were coated, some with one and others with two, three, or more coats of paint, and then exposed to the action of steam for a whole day, after which the paint was removed, and the surface of the plates examined. Those plates with one coat only were found to be as bright as before; those with two showed a few rust spots, while those with three and four were attacked to a greater extent. It is explained that the deeper layers dry badly, and tend to dissolve the uppermost coating, increasing its porosity to moisture. Plates should therefore be covered with only one coat of paint, and any old paint removed before doing so. (The *International Sugar Journal* February 1918.)

PRESERVATION OF VEGETABLES BY FERMENTATION AND SALTING.

Among the methods of preserving vegetables for future use, worthy of consideration at this time, are those based on fermentation and salting. *Farmers' Bulletin*, No. 881, of the United States Department of Agriculture, contains full directions for carrying out these processes at home. One advantage that these methods possess is that use may be made of wooden kegs, butter tubs, stone or glass jars, even without covers, if thoroughly cleaned.

The methods of preservation considered in the bulletin are grouped under three heads: (1) fermentation with dry salting, (2) fermentation in brine, and (3) salting without fermentation.

Fermentation with dry salting consists in packing the material with a small amount of salt. No water is added, for the salt extracts the water from the vegetables, and forms the brine. The method in general is as follows:—

Wash the vegetables, drain off the surplus water, and weigh them. Salt, in the proportion of 3 per cent. by weight of the vegetables, is required. Cover the bottom of the container with a layer of the vegetables about 1 inch thick, and sprinkle over this a little of the salt. Try to distribute the salt equally among the different layers so that the quantity weighed out will be sufficient for the quantity of vegetables packed. If a little of the salt is left over it can be added to the top layer, but if more has to be added than has been weighed out the finished product will taste too salt. Continue adding layers of the vegetables sprinked with salt until the container is about three-fourths full. Sprinkle the last of the salt on the top layer, and spread over it one or two thicknesses of cheese-cloth, tucking them down at the sides. On the cloth place a round piece of board which may be of any kind of wood except yellow or pitch pine, or a plate, and on this put a clean stone or one or two clean bricks. The size of the weight depends on the quantity of material being preserved. The weight added should be sufficient to extract the juices to form a brine, which will cover the top in about twenty-four hours. Sometimes it may be necessary to add more weight if the brine does not form readily.

After it is packed allow the container to stand in a moderately warm room to ferment. The stone and the board serve to keep the vegetables beneath the surface of the brine formed. Fermentation requires from eight to ten days in warm weather. It is shown by bubbles rising to the surface of the liquid. When bubbling stops, fermentation is complete.

The surface of the liquid must be treated to prevent the development of micro-organisms which feed upon the acid formed in fermentation, and develop into a heavy mould which will eventually destroy all the acid and spoil the fermented material. One method of accomplishing the exclusion of air from the surface of the brine in order to prevent the formation of mould is to fill the container as full as possible with the material fermented, and after allowing part of the gas to escape in the process of fermentation, to remove the board and weight, and to seal the container up tight. A better method, apparently, is to use an oil like cotton-seed oil, which, floating on the surface, effectually prevents air from reaching the brine. Brine covered with a layer of cotton-seed oil about $\frac{1}{4}$-inch thick will keep indefinitely. Before the vegetables are to be removed, the oil should be skimmed off the surface of the brine. A third method is to cover the surface with very hot melted parafin, which makes a perfectly air-tight seal.

It is stated that under home conditions the following vegetables have been preserved successfully by the above method of fermentation by dry salting: cabbage, string beans, beet tops; and it is probable that others might be added to this list.

Some vegetables are better fermented by covering them with a weak brine in the following way:—

After the vegetables are washed and drained, they are packed into a container until it is nearly full. A weak brine for use is prepared as follows: to each gallon of water a pint of vinegar and three-fourths of a cup of salt are added, the mixture is stirred until the salt is entirely dissolved. The amount of brine necessary to cover the vegetables will be about equal to one-half the volume of the material to be fermented. This is easily calculated by measuring the contents of the container used. Pour the brine over the vegetables, and provide for pressure as described above. When fermentation has stopped, the surface of the liquid should be treated to prevent mould, by one of the foregoing methods.

The following vegetables have been preserved satisfactorily in this way: cucumbers, string beans, green peas, corn, beets, and green tomatoes.

In the method of preserving vegetables by salting without fermentation, they are packed with enough salt to prevent fermentation or the growth of yeast or mould. As in the foregoing methods, the vegetables are washed and drained. They are then weighed, and salt is provided in the proportion of one-fourth of the weight of the vegetables. The method employed in packing is the same as in the first method described. The salt ought to be distributed evenly among the different layers, so that the quantity weighed out will be just enough to pack the vegetables. When the container is nearly full of alternate layers of vegetables and salt, it should be covered with the clean cloth, board, and weight, as in the method of fermentation by dry salting. If the salt and pressure of the weight have not extracted sufficient brine to cover the vegetables after twenty-four hours, enough strong brine, prepared by dissolving 1lb. of salt in 2 quarts of water, should be poured over the vegetables to come up to the wooden cover. There will be a small amount of bubbling at the start, but this will not continue long. As soon as the bubbling has stopped, the surface of the liquid should be protected in one of the ways described above.

In general, the fermented and salted vegetables may be prepared for the table in much the same manner as fresh vegetables, except that before being cooked they should be soaked in fresh water for several hours to remove the salt, the water being changed several times. The amount of salt or acid taste to be thus removed depends upon the flavour desired. If a decidedly acid flavour is desired, fermented vegetables, after being removed from the container should be rinsed thoroughly in fresh water, and then cooked without soaking. If one does not desire the acid flavour, it may be modified to any extent, or removed almost entirely, by soaking the fermented vegetables for as long as necessary, and changing the water several times.

In the Report of the Commmissioner of Agriculture and Labour of Porto Rico for 1917, it is stated that the breeding work with sugar-canes in that island has now reached a point where several new varieties have been developed which give promise of being superior under local conditions to any at present grown. Several of these canes have been tested on the estates of two centrals, and a few of them have been specially selected for superior characteristics

VARIABILITY OF YIELD IN FRUIT TREES, AND ITS EFFECT ON FIELD TRIALS.

The importance of the wide natural differences in yield which may occur in fruit trees grown in closely adjacent positions under apparently uniform conditions has on several occasions been emphasized in this Journal. Its effect is to render extremely doubtful the validity of comparisons made in trial plots unless careful measures are taken for its elimination, so far as this is possible, and full allowance made for it, so far as it may still exist.

The results of an elaborate study of the influence of this factor are now available in a paper by Professors L. D. Batchelor and H. S. Reed, of the University of California Citrus Experiment Station, which appears in the *Journal of Agricultural Research*, Vol. XII, No. 5. Careful consideration of the conclusions reached, which are reproduced below, is recommended not only to experiment station workers, to whom the matter is of the first importance, but to growers, who usually, and very naturally attribute significance to the effects of differing treatment on evidence which analysis may prove to be wholly insufficient.

It may be explained that the coefficient of variability, as used below, expresses as a percentage the extent to which variation is found to occur in the given case. If there is no variation the coefficient is zero; if there is wide variation the coefficient is high.

'(1) The present paper is the result of a study of the nature and extent of the casual variability of yields of fruit trees under field conditions, and its bearing on the reliability of plot trials.

'(2) Studies have been made upon the variability of the yields of orange, lemon, apple, and walnut trees. The orchards studied were selected on account of uniformity of treatment and appearance, yet the variability in productivity was considerable. The coefficient of variability for the yield of individual trees of the clonal varieties ranged from 29·27 ± 0·69 to 41·23 ± 1·52 per cent., but for the individual seedling walnut, the coefficient was somewhat higher reaching 53·91 ± 1·92 per cent. The variability of these tree yields approaches the normal curve of errors. This variability may be assumed to be the result of "casual" factors which are beyond the control and possibly the recognition of a careful experimenter.

'(3) The effect upon variability of combining trees into plots of various sizes and shapes has been investigated. As the number of trees per plot is increased, the coefficient of variability decreases. The coefficient of variability does not decrease, however, in proportion to the increased number of trees per plot. In most cases there is little gained in accuracy by increasing the plot to include more than eight adjacent trees.

'(4) One of the great causes of variability in yields appears to be the heterogeneity of apparently uniform soil. While a combination of a sufficient number of adjacent trees into a plot will overcome largely the fluctuations of individuals, nevertheless the plots may not sufficiently include both high and low-yielding areas to give a typical average. Greater reliability may be secured by a systematic repetition and distribution of plots through the experimental area. A consistent gain in reliability resulting from this method of repetition is shown by the use of several different methods of computing the variability.

'The coefficient of variability for an average plot of sixteen adjacent trees was 22·58 ± 1·01, while sixteen trees in four scattered ultimate plots each of four trees have a coefficient of variability of 9·29 ± 0·40. The larger the number of units in a combination plot the more typical is the sample of the area obtained. A sixteen-tree plot can be expected to give more reliable results if divided into four equal plots and repeated at four regularly placed intervals than can either two eight-tree plots, or sixteen adjacent trees. The same principle holds true for larger units. A given number of unit plots will give a greater accuracy than half the number of units with twice as many trees per unit.

'Four repetitions of an ultimate plot reduced the coefficient of variability to a point considered practical for cultural operations. Further repetitions, though reducing the coefficient in less degree, did not appear to justify the additional number of trees required. A minimum of eight to ten trees is required for plots involving cultural experiments. In the case of root stock, pruning, or variety trials, twice as many plots each containing half as many trees might be used to obtain greater accuracy.

'The fact that marked soil variations occur which tend to make adjacent trees or adjacent plots yield alike, even on soils which were chosen because of their apparent uniformity. is well shown by applying the formula proposed by Harris (1915) for measuring the coefficient of correlation between neighbouring plots of the field. Applying this to the Arlington navel oranges, the writers have calculated the correlation between the yield of the eight-tree plot as the ultimate unit, and the yield of the combination of four such adjacent plots, and it was found that the result shows a marked correlation, indicating a pronounced heterogeneity in the soil of this grove influencing fruit production. However, when the correlation between the eight-tree plot as the ultimate unit, and the yield of the combination of four such systematically scattered plots was calculated, it was found that the coefficient is practically equal to its probable error, and can be regarded as significantly zero.

'(5) In the computations made by the writers, emphasis is also laid upon the nature and magnitude of the probable error. It is shown in several cases that the probable error of comparison between plots may be so large that relatively large differences must be evident between treated and untreated plots, for a reasonable assurance that it is due to the factors being exprimented upon. With the plots of sixteen to thirty-two adjacent trees which were studied, a difference of from 62·94 to 81·97 per cent. of the mean production would be necessary in order to obtain chances of 10 to 1 that the results were due to differential treatment and not to casual variation in the productivity of the trees. With the same number of trees in scattered units, a difference of 28·42 to 50·02 per cent. would be necessary for the same odds. It seems probable, therefore, that a difference between two tree plots of less than 50 per cent. of the mean production should be considered with caution before attributing it to differential treatment.

'(6) The relation between the shape of a plot and its variability was investigated by making comparisons between square plots and linear plots containing the same number of trees. Except in the case of large plots, the difference in the variability of plots of different shapes was insignificant.

(7) In any method of field experimentation where a standard of comparison is desired, the theoretical or "normal" yield of a plot is a question of importance. By the use of certain formulas the "normal" yield may be computed from control plots. As a standard one may use the average yields of the control plots of the entire area, or of the nearest control plots, or a combination of the two. In cases studied the coefficient of variability was reduced 50 per cent. by calculating the normal yield from the nearest controls in

place of using the mean of the entire area. The employment of every alternate row as a control plot was not sufficient to offset the variability due to soil heterogeneity.

'(8) Computations made on the yield of orange, walnut, and apple trees, for several consecutive years, showed little annual fluctuation in their variability. One or two crops may not show greater variability than the average of six or seven crops.'

DEVELOPMENT OF THE SOUTHERN PHILIPPINES.

The outlying territories of the United States comprise some rich and fertile lands, such as the Philippines, Hawaii, and Porto Rico, the devolopment of whose resources the Americans have undertaken with remarkable energy. Conspicuous progress has been made in the Southern Philippines (department of Mindanao-Sulu) during the last few years, according to an American Consular report,, and a noteworthy development of this rich, virgin country may be expected. The chief fields for investment are in the production of hemp, coco-nuts, lumber, cattle, and now rubber, which has hitherto been neglected because, says the report, a scientific investigator decided some years ago—erroneously, it has since been proved—that the region was not suited to that crop. When it was decided scientifically that rubber could not profitably be grown in Mindanao, a large American rubber company established its plantation in the Dutch East Indies instead. A smaller enterprise, however, persisted, and its success has revealed the entirely erroneous character of the scientist's findings. The company now has 72,000 Para rubber trees growing on the island of Basilan, of which 22,000 have come into bearing. A leading rubber expert has now stated that he is favourably impressed with the rubber-growing possibilities of the region.

NEW USES FOR MANILA HEMP. Though rubber is one of the most promising plantation products of Mindanao, the leading and best paying commodity at the present time is Manila hemp, growers of which are realizing prices four or five times those which they obtained and found profitable a few years ago. The finest grades of Davao hemp command the equivalent of £175 a ton. Such high values are attributed to war demands, reduction in the output of sisal in Yucatan and German East Africa, and new uses for the finer grades of hemp in the manufacture of textile fabrics. The Japanese have been the foremost in developing new uses for Manila hemp in textile manufacture, and Japan is the leading market for the finer Philippine grades. As the best of these are produced in Mindanao, Japanese enterprise has interested itself especially in that region. Japanese buyers are said to be offering contracts for hemp deliveries over long periods of years.

COCO-NUTS. The position of hemp as the leading and most profitable product for the time being is due mainly to war conditions, and it is felt that the coco-nut will probably in due course take a leading and permanent place in the agricultural development of Mindanao. Two large copra crushing plants are now in operation in the Philippines; the greater part of the copra, however, is shipped as such, though the exports of oil are rapidly increasing. Before the war Marseilles was the chief destination of the copra, but San Francisco is now of greater importance. Substantial and rapid development of coco-nut planting is expected in Mindanao, whilst many thousands of palms will come into bearing during the next few years. (The *Chamber of Commerce Journal*, February 1918.)

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of February 1918:—

The condition of the produce markets for the month of February shows little or no change from that which prevailed throughout January, and indeed throughout the whole twelve months of the previous year, due to the continued shortage of imports from lack of tonnage, and the dangers of loss on the high seas. With prices ruling high for most products, the tendencies of buyers is to limit their purchases only to such quantities as will meet their own immediate requirements.

ARROWROOT, TAMARINDS, AND SARSAPARILLA.

Of products that have commanded higher rates during the month may be mentioned arrowroot, tamarinds, and grey Jamaica sarsaparilla. Of the former there was a good supply at auction on the 14th of the month, when good manufacturing St. Vincent met with a ready sale at $8\frac{3}{4}d.$ to $9d.$ per lb. A week later some 22 barrels were offered and bought in at the former figure, and at the close of the month sales were effected at $9d.$ to $9\frac{1}{2}d.$ per lb. At the beginning of the month tamarinds were reported to be scarce, 65*s.* to 70*s.* per cwt. being paid for good Barbados. At the end of the month the price had advanced to 77*s.* 6*d.*, duty paid. The offerings of sarsaparilla on the 14th of the month were as follows: grey Jamaica 36 bales and Honduras 6. Of the former, 14 bales were disposed of fetching 4*s.* per lb. None of the Honduras was sold, 3*s.* 6*d.* per lb. being asked for it.

GINGER, LIME JUICE, ANNATTO, KOLA, CITRIC ACID, AND CASSIA FISTULA.

At the last spice auction in the month, namely on February 28, the quotations for Cochin and Calicut ginger were from 65*s.* to 70*s.*, and for Japanese 55*s.*, at which prices a good amount of business was done. At the first auction on February 7 lime juice was in good supply at from 3*s.* 3*d.* to 3*s.* 6*d.* per gallon for prime, and 3*s.* for good. At the auction on the 21st of the month it was still in good supply, new crop raw Jamaica being obtainable at the above figures. Annatto seed was represented at auction on the 14th of the month by 80 packages, but no sales were effected. Kola was also well represented at the same sale by 189 packages, and 144 were disposed of at the following rates: good bright Java halves at $9\frac{1}{2}d.$ per lb., good bright Dominica $8\frac{1}{2}d.$; some 95 packages of African, consisting of damaged and partly mouldy, realized from $7d.$ to $7\frac{1}{2}d.$, and good fair quarters, slightly mouldy, $10\frac{1}{4}d.$ Citric acid has been firm throughout the month at 3*s.* 2*d.* per lb. Quite at the end of the month good sound Cassia Fistula pods from Java were quoted at 90*s.* per cwt.

California marsh vegetation, particularly the tule plant (*Scirpus lacustris*), contains potash which may be somewhat easily obtained by drying and burning. The ash may be used directly, or high grade potash salts may be extracted by simple, inexpensive methods. Potash recovery from tule may be of considerable local importance as a source of potash at times such as the present. (*Bulletin*, No. 288, Berkeley College of Agriculture Experiment Station, California.)

MARKET REPORTS.

London.—The West India Committee Circular, March 7.

Arrowroot— 9*d.* to 10*d.*
Balata—Venezuelan Block, 3/5½; Sheet, 3/8 to 4/-.
Beeswax—No quotations.
Cacao—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, 92/6 to 115/- per cwt.
Honey—Jamaica, 160/ to 175/- per cwt.
Lime Juice—Raw, 3/3.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—4*d.* to 4¼*d.*
Rubber—Para, fine hard, 2/8; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., March 27.

Cacao—Venezuelan, $13·25 to $13·75 Trinidad, $13·50 to $14·00.
Coco-nut Oil—$1·36 per gallon.
Coffee—Venezuelan, 11c. to 12c. per ℔.
Copra—$8·00 per 100 ℔.
Dhal—$14·00.
Onions—$8·00 per 100 ℔.
Peas, Split— $11·50 to $12·00 per bag.
Potatoes—English, $6·00 per 100 ℔.
Rice—Yellow, $12·00 to $12·25; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., April 3.

Cacao—Caracas, 13½c. to 14c.; Grenada, 14c. to 14½c.; Trinidad, 14¼c.; to 14¾c. Jamaica, 13¼c.
Coco-nuts—Jamaica selects, $58·00 to $60·00; Trinidad selects, $55·00 to $56·00; culls, $22·00 to $30·00 per M.
Coffee—Jamaica, 10c. to 12c. per ℔.
Ginger—15½c. to 20c. per ℔.
Goat Skins—Jamaica, 75c.; Antigua and Barbados, 75c.; St. Thomas and St. Kitts, 75c. per ℔.
Grape Fruit—Jamaica, $2·75 to $3·00 per box.
Limes—$13·00 to $13·50 per brl.
Mace—36c. to 40c. per ℔.
Nutmegs—23c.
Oranges—$5·00. to $7·00
Pimento—6¾c. to 7½c. per ℔.
Sugar—Centrifugals, 96°, 6·005c; Muscovados, 89°, 5·005c. Molasses, 89°, 4·948c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., April 2.

Arrowroot—$10·00 per 100 ℔.
Cacao—$12·50 per 100 ℔.
Coco-nuts—$36·00 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $4·75.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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Qualities in Cacao Desired by Manufacturers.

ONE of the most striking developments of recent years in the cultivation of a particular crop in a locality where no attention was previously paid to it, is the cacao industry in the Gold Coast Colony. In the year 1891 there was officially recorded the first exportation of cacao from the colony. It was 80 lb. in weight, valued at £4. In 1916 the official reports place the exports at 72,161 tons, of the value of £3,847,720. The Gold Coast has become in fact, in the short space of twenty-five years, the greatest producer of cacao in the world, supplying nearly one-quarter of the total world production of this valuable foodstuff.

The industry is almost entirely in the hands of natives on small holdings, to which fact may be attributed the low grade of the cacao which is mostly shipped, as not much trouble is taken in harvesting or preparing the beans in order to obtain the best results. Consequently the price which the product fetches on the market is only very low as compared with that of Trinidad or Grenada cacao.

The large quantity of cacao, produced at low cost, must however have an effect on the market in lowering prices generally, and it would seem that, if cacao production in the West Indies is to continue to hold its place, the planters will have to strive, not so much after producing quantity, for in that they will not be able to compete with other sources of supply like the Gold Coast, but after improvement of quality.

A useful analogy may be derived from the local cotton industry. It would be hopeless for these islands to compete in the production of Egyptian or American Upland, but from specializing in a type, for which the demand is relatively small but the prices high, the industry retains, to all appearance, the prospects of continued prosperity.

By cacao of a high quality we mean the cacao which is regarded as most desirable from the manufacturer's point of view. A paper published in the Transactions of the Third International Congress of Tropical Agriculture, which was held in London in June 1914, is full of very valuable hints on this question, from the point of view of the cocoa manufacturer. The authors of the paper referred to, Messrs. N. P. Booth and A. W. Knapp, of Messrs. Cadbury Bros., Ltd., say that they believe there are many planters who

would be glad to know exactly what qualities in cacao are considered desirable by manufacturers of cocoa and chocolate. Unfortunately, it is by no means possible to make a definite statement which is generally applicable, because the various manufacturers look for different qualities, and cacaos from certain districts are prized for special purposes. There is, further, some danger in describing a desirable appearance, for it is not the appearance that is wanted, but the qualities that are associated with it. In general, it is indicated that if the planter only allows ripe pods to be gathered, ferments for a reasonable period, cures with care, and keeps the beans dry, they will have the right appearance to satisfy the manufacturers, and he will be producing the best that the type of tree on his plantation is capable of. It is to be regretted that in many cases the individual who does better work than his fellow-planter does not directly reap his reward in higher prices. Indeed, it has been said by planters that it does not pay to take more than a certain amount of trouble in fermenting and curing their cacao, as they obtain the same price any way; but if all planters worked down to the minimum quality, the price obtained for beans from that district would fall, and all would suffer. At present the planter who produces above the average is a benefactor to his fellow-planters, and he who produces below the average quality lowers the price of the whole production of his district.

Any district which could establish and successfully maintain a standard which prohibited the presence of unfermented, diseased, germinated, or grubby beans, and which fixed a maximum percentage for rubbish and shrivelled beans, and could at the same time put on the market large consignments suitably marked, would be sure of establishing a reputation in the London market, and as a result obtain high prices.

Probably the most highly appreciated character is constancy or reliability of quality. Cacao which varies from bag to bag, or from time to time, will get little appreciation. Under ideal conditions, standard qualities would be put on the market—Criollo, Forastero, and Calabacillo would be fermented separately, and the beans graded according to size. Such a procedure would only be practicable where the cacao from several plantations was taken to a central fermentary. At the present time we are far from this: indeed, instead of a careful grading of good qualities there is in practice a mixing of good and bad. There is good reason to believe that some merchants buy cacao which they know to be diseased, or unfermented, or mouldy, and deliberately mix it with good cacao. Such an action may not seriously affect the price of that particular lot, but it affects detrimentally the reputation of the cacao from that district, and the manufacturer comes to regard it as less desirable.

A matter of great importance, within the control of the careful planter, lies in the picking of the pods at the right stage, neither under nor over-ripe. It is in this connexion that thrips, by concealing the signs of ripeness, probably do more real and widespread harm than in their effects upon yield.

It is sometimes stated that cacao is valued largely according to its geographical origin, but it may be pointed out that this value is the resultant of the value of the type of bean grown in that district. It is also sometimes contended that the value of cacao depends almost entirely on its botanical variety. It is the old problem of heredity and environment. Criollo obtains a higher price than Forastero and Calabacillo, because it is the rarest. But the planter's problem in most parts of the world is how to produce the best cacao from the mixed breed which his plantation contains. This is done by providing a suitable environment, i.e. keeping the trees under healthy conditions, and by curing the cacao with the greatest care. In Ceylon, since rubber became of such great importance, less care has been taken in the cultivation of cacao, and a deterioration has resulted.

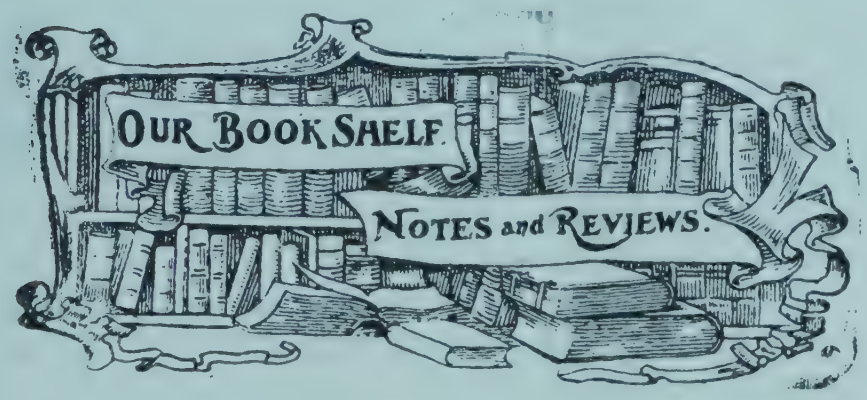
It should be pointed out that the manufacturer does not make a final judgment of the bean in its raw state. It is only when it is roasted that he is able to determine its exact value for his purpose.

The question of co-operation between planters and manufacturers is of great importance in the production of almost every crop. Continuous efforts have been made in connexion with the cotton industry in the West Indies to discover exactly what quality of cotton is most valued by the spinners in Manchester. These efforts have resulted in mutual benefit to planters and manufacturers, enabling the latter to obtain the more uniform product for which they are willing to pay a higher price.

With cacao, as with cotton, it would appear that uniformity is the first essential, a point which is easy to understand when the standardized nature of modern manufactured products is considered.

As has just been pointed out, much can be done in this direction by careful preparation of the raw material, by picking at just the right time, and by the

grading of the material of differing quality. But in the end, however long it may continue to be evaded, the matter is bound to become one of growing pure strains instead of the present mongrel collections to be seen on cacao estates. This question will be further considered in a subsequent issue.



IMPERIAL INSTITUTE HANDBOOKS: COTTON AND OTHER VEGETABLE FIBRES; THEIR PRODUCTION AND UTILIZATION. By Ernest Goulding, D.Sc., F.I.C., with a preface by Wyndham R. Dunstan, C.M.G., LL.D., F.R.S., pp. 231 + viii, Plates XII. London: *John Murray*, 6*s.* net.

This volume of the Imperial Institute Handbooks to the Commercial Resources of the Tropics is intended as a general summary of the position and prospects of the world's production and utilization of fibres, in view of the increased attention which must shortly be given to extending the sources of supply. The author is described as having been for many years in charge of the fibre section of the Scientific and Technical Department of the Imperial Institute.

Three of the eight chapters of the book deal with the subject of cotton, its origin and cultivation, the main sources of world supply, and the development of cotton production in the British Empire. The remaining chapters relate to the nature and production of flax, hemp, ramie, jute, the cordage hemps, and miscellaneous fibres.

For the commercial or the general reader, especially if it is used in connexion with the exhibits at the Imperial Institute Galleries or in provincial collections, the book should be of considerable educational value. If the ideas which are now current with regard to fuller development of the agricultural resources of the colonies are to result in action, it is essential under our forms of government that an intelligent interest in colonial products and their uses should be cultivated, and for that reason the issue of handbooks such as the one under notice is to be welcomed. But while this view of the function of the book would seem to be most in keeping with the origin of the series, some parts of the discussion in the section relating to cotton tend to pass from description into advice in matters more appropriate for an agricultural treatise.

The difficulties of counsel with regard to the subjects of manuring, of seed selection, of the treatment of pests and diseases, are perhaps greater in respect of cotton than of any other crop, for in none is adjustment to local conditions a more delicate matter. When information has to be compiled, as it very evidently has been in the present case, from publications of varying age and authority, it affords a very unsafe basis for recommendations regarding agricultural practice. Very marked progress in the application of science to cotton growing has been made in the last dozen years.

The most successful example so far of the deliberate development of cotton production in the British Colonies, the Sea Island industry of the West Indies, stands in direct opposition to the statement on page 29 that 'if there is already a native cotton plant which appears capable of yielding a satisfactory crop, attention should be primarily directed towards the improvement of this variety.' Had such a view been taken in 1900 these islands would be producing a selected Marie Galante, the only type of commercial significance which was to be found here. (The idea that Sea Island cotton originated in the West Indies is hardly more than a legend.) That this would have remotely approached the quality of Sea Island is about as unlikely as getting a quart out of a pint pot.

Nor can the information that 'considerable improvement can be achieved by simply picking out large, ripe, well-developed seeds for sowing' or, without some hint of limitation, the statement that 'if it is desired to increase the length of staple the seeds should be selected from those plants which produce the longest fibre' be regarded as showing biological insight of a high order. That experiments in the direction of improving cotton by hybridization should only be undertaken by a competent botanist is certainly true, and the reference could well have been made wider.

The information regarding pests and diseases of cotton might reasonably have been expected to be somewhat more modern. Angular leaf spot, e.g., here classed as a physiological disease, was proved by inoculation to be of bacterial origin in 1905 or earlier; the announcement of this reached popular form in a *Farmers' Bulletin* of the United States Department of Agriculture in 1907, and would hardly be questioned by anyone who has seen the disease. *Neocosmospora* as the cause of wilt has been discredited since 1910. Bacterial boll rot may, as stated, start at a point near the peduncle, but it may equally well start near the tip of the boll, and can occur over any part of the intervening surface. *Dysdercus* is, as usual, described as staining the cotton in the open boll with its excrement, while the best remedial measure against this insect is said to consist in the attraction of the bugs to heaps of cotton seed or sugar-cane on which they can be destroyed by kerosene or boiling water, a remedy which is likely to prove a disappointment to those who try it. That the leaf-blister mite does not usually do much harm to full-grown plants is hard to be believed by anyone who has seen the havoc it commonly produces on the secondary growth.

There are considerable differences of usage among botanists with regard to terms for the bracts subtending the cotton flower, but the latitude can hardly be extended to cover a description of the young fruit as enveloped in the calyx. The account of the petals changing in colour until the third or fourth day might readily be taken to mean that the flower opens or remains open after the first day, which would be contrary to the habit of any variety known to the reviewer.

There is no intention to disparage Dr. Goulding's book in making these criticisms: they apply to no more than a few pages which do not concern the main purpose of the book as it is stated in the preface. They may serve as useful illustrations, with a quite general application, of the dangers which wait upon attempts to issue detailed advice concerning agricultural matters in the colonies from centralised institutions in London.

W.N.

SUGAR INDUSTRY.

SELECTION OF CANE CUTTINGS BEFORE PLANTING.

An instructive article on this subject by Mr. Arthur H. Rosenfeld, late Director of the Tucumán Experiment Station, Argentina, appears in the *International Sugar Journal* for February 1918. His conclusions are based upon demonstrative experiments undertaken at the Tucumán Station. Nowadays the principle of the value of selection for the maintenance or improvement of the characters of any plant or animal would seem to be such a settled question as to render experiments in this line unnecessary. Nevertheless it is often the case that the most common facts are those which are ignored in our daily agricultural routine, and it frequently happens that experiments along the most common lines of investigation, if conducted on sound scientific principles, result in calling the attention of agriculturists to facts not unknown but forgotten. Recognizing, as accepted by every intelligent planter, the value of selection in general, two series of experiments were conducted at the Tucumán Experiment Station in selecting cane before planting.

The selection was made principally with the object of planting cane as free as possible from the common moth cane borer (*Diatraea saccharalis*), but the results obtained are a further indication of the value in general of selection of cane cuttings. Selecting cuttings free of borer attack and the diseases introduced through the perforations really means a selection of sound, healthy cane, and this is the basis of all seed selection. Mr. Rosenfeld states that the selection of borer-free canes did not represent a careful selection of other characteristics than freedom from borer attack; in fact the selected cane was inferior as regards size, development, etc., to the ordinary cane used for planting in the control plot. This was undoubtedly due to the fact that the larger, thicker canes, offering a larger surface to the attacks of the borer, were infested very heavily, a larger proportion of thin canes being found free of the borer than of the better developed specimens.

In conducting these experiments, apart from the actual selection of cuttings as free as possible from borer attacks and the fungus diseases which gain entrance to the cane through the perforation of the borer, there was no difference made in the cultivation of the selected and non-selected plots of cane, the latter having been planted with the type of cane usually planted in the neighbourhood—cane of good appearance in general, but without any attention being paid as to whether it was infested with borers, or whether a large proportion of the eyes had been destroyed by this insect, or from other causes.

The first experiment was begun in August 1910, and careful counts were made at frequent intervals of the number of sprouts above ground in the two plots. The difference in appearance between the plots planted with selected and unselected cane was most noticeable from the beginning of the germination. The following table gives the results of these germination counts at various dates in number of sprouts above ground per row of 100 metres:—

Plot.	Oct. 17.	Dec. 1.	Dec. 12-16.	Crop.
Selected	153	606	1,203	1,111
Unselected	44	464	874	942

It will be observed that in every count the selected cane showed much better germination than the unselected—so much so, in fact, that all the canes which existed in the selected plots on December 16 could not mature, the number of matured stalks however still being far greater at crop time in the selected plot than in the unselected. It is interesting to note also that the average weight of stalks from the selected plot was just 40 grammes more than that of the stalks harvested from the unselected plot.

The next table makes clear how this difference in germinative power bears upon yield. It must be borne in mind also, that the same money will be spent on producing inferior cane per acre as on producing good cane, hence the cost of cultivation per ton of superior cane is always less. This table would also appear to demonstrate that if unselected cane is planted, it is only putting into the ground a great amount of cane which cannot germinate with full efficiency, and which would have been much better sent to the mill, replacing it with selected cane of high germinating power.

The following table shows the result of the experiment in yield of cane in kilograms per row of 100 metres, both for plant canes and for ratoons:—

Plot.	Plants.	Ratoons.
Selected	954	582·3
Unselected	776	481·3

From this table it appears that the selected canes, both as plants and as ratoons, gave over 20 per cent. more yield in each case than those of the unselected. This increase in production, with probably the same cost of cultivation per acre, certainly repays many times the small cost of selection.

An interesting part of this experiment was the determination, by careful examination of several hundred individual canes from each plot, of the percentage of cane containing cane borers when cut at crop time. The results of the count showed that 37 per cent. of the selected plot contained live specimens of cane borer, and that 60 per cent. of the cane from the unselected lot harboured this pest. That is to say, that even in small plots a careful selection of the cane as free as possible from borers at the time of planting gives direct results in the diminution of the consequent infestation by the insect. As Diatraea is not a strong flier, it would appear that the results should be still more pronounced by the selection of cane plants over large areas.

The experiments described above were made under irrigation conditions. But in order to continue the demonstration of the benefit of selection, another experiment was made with canes planted in unirrigated land. In both series the cane was planted in rows 5 feet apart, employing two complete running rows of cane for planting, and in both series the cane for planting was hand stripped, the seed cane being covered in the rows with a small share plough. The following table shows the results of the germination counts on the cane grown in unirrigated land:—

Plot.	Oct. 18.	Oct. 26.	Nov. 14.	Crop.
Selected	140	356	636	660
Unselected	120	292	464	524

As in the previous experiment, the counts were per row of 100 metres.

Although the difference between the number of sprouts above ground in the two plots is not so striking as in the first series of experiments, it nevertheless plainly shows again the advantages of selection.

The following were the results in kilograms per row of 100 metres of the crop reaped on August 15 of the following year:—

Selected	662·8
Unselected	547·7

Here again is shown the same increase of yield of the selected over the unselected cane—just a little over 20 per cent. This represents pure profit to the planter, as he would have spent the same amount in cultivating an acre of the unselected cane as of the selected.

The results of these experiments appear very striking. They seem to indicate that a more systematic selection of cane cuttings is highly profitable, and it must always be remembered that canes rejected for planting purposes do not represent a total loss, as they can always be sent to the mill for grinding.

PALMS AS A COMMERCIAL SOURCE OF SUGAR.

An interesting paper on the above subject, much of which we reproduce below, by H. E. Annett, B.Sc., F.I.C., F.C.S., Agricultural Chemist to the Government of Bengal, is published in the Transactions of the Third International Congress of Tropical Agriculture.

It is not generally known that the world's production of palm sugar is about 500,000 tons annually. Most of this is produced in India, but a proportion is also produced in the Philippine Islands and in the Dutch East Indies.

It is known that a large number of palms produce sugar. Among them the following have been recommended for sugar production on a commercial scale:—

The wild date palm (*Phœnix sylvestris*), by far the commonest sugar producer among the palms in India.

The fan or toddy palm (*Borassus flabelliformis*), grown for the production of sugar in Madras and Burma.

The coco-nut palm (*Cocos nucifera*), also fairly largely used in Madras for the same purpose.

The Nipa palm (*Nipa fruticans*), from which the palm sugar of the Philippine Islands is chiefly obtained. This is a swamp palm, growing almost up to its crown in water in marshy places by the sea.

Caryota urens is also used for the production of sugar to a small extent in Madras; it has been credited with enormous sugar yields on the Malabar coast.

Arenga saccharifera appears to be commonly used for sugar production in the Dutch East Indies.

The sugary juice is obtained from the young inflorescence in the case of the above palms, with the exception of the wild date palm, the stem of which is tapped just below the crown of the leaves.

The Nipa palm contains 16 to 17 grammes of cane sugar per 100 c.c. of juice, while the wild date palm only contains 10 to 12 grammes of cane sugar in the same amount of juice. The toddy palm juice contains about 14 to 16 grammes of cane sugar per 100 c.c. Investigations carried out during the palm sugar season in Jessore district, Bengal, show that even by the crude methods practised there, an average of about 22lb. of raw sugar is obtained per tree during the season in the case of the wild date palm. Reckoning 350 trees per acre, which is a fair estimate, this would yield 3·6 tons of raw sugar per acre. The yield of sugar from the toddy palm would probably considerably surpass the yields from the wild date palm, while figures given from the Philippines seem to indicate very large yields of sugar from the Nipa palm.

The following are the advantages which Mr. Annett claims that palms offer as a source of sugar supply:—

(1) The certainty of the yield year after year. There need no fears be entertained of drought or of flood. Both of these occurrences have practically no effect on the yield of a palm plantation.

(2) The small annual cost of the upkeep of a plantation.

(3) No capital needs to be invested in crushing machinery, which is such a large item in sugar-cane factories.

(4) Owing to the fact that different palms yield sugar at different seasons of the year, it might be possible by combining the cultivation of the wild date palm with the toddy palm, practically to produce sugar almost all the year round.

(5) The juice of the palms is easily treated in a factory. It would require much less defecation than cane or beet juice. Owing to the alkaline reaction of the juice to litmus, even liming would be unnecessary.

(6) It would seem possible by better cultivation and plant selection largely to increase the yield per acre, and thus obtain more sugar per acre than even from sugar-cane.

On the other hand, the following are the disadvantages of palms as a commercial source of sugar:—

(1) Lack of fuel.—In the cane sugar industry the megass which is obtained after extracting the juice from the cane supplies sufficient fuel for the needs of the factory. There is no such fuel in the case of palm trees.

(2) Time of establishment of plantation.—A period of six years elapses from the time of seed planting until the trees can be tapped for sugar. During this time, however, certain crops such as peas may be grown on the land. And further, when once established, the plantation needs very little annual upkeep, and each tree, in the case of the wild date palm at least, will go on yielding for twenty-five years.

(3) Difficulty of collecting the juice.—At present this would seem to be one of the chief drawbacks, but it might be possible to develop a system of pipe lines from the fields to the factory.

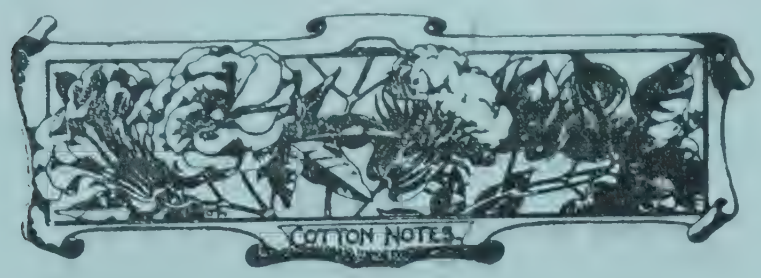
(4) The concentration of the sugar in the juice.—In the case of the wild date palm, with only 10 to 12 grammes of sugar per 100 c.c. of juice, the work of evaporation would be very much more tedious than in the case of cane juice. The Nipa palm, and perhaps others, would be better than the date palm in this respect.

The writer of the paper referred to comes to the conclusion that, since it is probable that much higher yields of sugar per acre could be obtained from palms than from sugar-cane, the advantages of palms as a source of sugar seem to outweigh the disadvantages.

He mentions that a small factory in the Jessore district, working on palm juice, has produced some very high quality white sugars from the juice. These sugars found a ready sale locally. No special treatment of any kind was used during the process of manufacture. After a small amount of preliminary heating, the juice was concentrated in a vacuum pan.

He suggests that a factory dealing with palm juice would be best run in conjunction with a distillery, so as not to be dependent on a fluctuating market for the sale of its molasses.

We would add that under West Indian conditions there appears to be another great disadvantage in palm plantations. A hurricane, which damages the sugar-cane fields considerably, only destroys the growth of a year, whereas in the case of palms it might completely destroy what it would take six years to restore.



COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending March 23, 1918, is as follows:—

ISLANDS. The market has remained very quiet for the odd bags classing Fine to Fully Fine, there being little enquiry at present; nevertheless the Factors continue firm in their asking prices, refusing to admit that they would make any concessions to sell.

The sales reported consist of Planters' crop lots of Extra Fine, on private terms, the buying being for export.

We quote, viz:—

Extra Fine 75c. to 80c = 77c. to 82c., c.i.f.
Fine to Fully Fine 73½c. to 74c. = 75½c. to 76c ,,
Fine to Fully Fine, off in preparation, 70c., to 71c. = 72c. to 73c, c.i.f
Fine to Fully Fine, stained, 65c. to 68c. = 67c. to 70c., c.i.f

GEORGIAS AND FLORIDAS. The Savannah market has been dull, with apparently no demand. The sales reported are purchases made in the interior, or cotton appropriated by exporters on orders from their holdings. There is a general disposition to hold firmly for quotations, the impression being that the unsold portion of this crop will all be required before the next crop is marketed.

We quote, viz:—

Fancy	74c. = 76c.	c.i.f.
Average Extra Choice	73c. = 75c.	,,
Choice	72c. = 73c.	,,

The exports from Savannah for the week have been, to Northern Mills 4 bales, Southern Mills 278 bales, and from Jacksonville to Northern Mills 311 bales.

On March 20 the United States Census Bureau made its final report of cotton ginned to March 1, as follows:—

South Carolina	7,313 bales	}			
Georgia	47,888 ,,	}	making a total of	92,501	bales
Florida	37,300 ,,	}			
against last year	117,544 ,,		total crop	113,109	bales
,, 1916	91,920 ,,		,, ,,	85,278	,,
,, 1915	81,598 ,,		,, ,,	78,857	,,
,, 1914	77,490 ,,		,, ,,	85,544	,,

DEPARTMENT NEWS.

Information has been received from the Imperial Commissioner of Agriculture for the West Indies, Sir. Francis Watts, K C.M.G., that by request of the Secretary of State for the Colonies he will proceed to the Bahamas on the conclusion of his visit to Jamaica.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. In items of Departmental interest during the month of March, Mr. W. N. Sands Agricultural Superintendent, mentions the distribution of 7,715 cane cuttings of selected varieties. With favourable weather conditions, ground provisions, corn, and other crops continued to thrive. Cotton picking was still in progress in several places at the end of the month. The eradication of John Bull stumps and seedlings which had made growth, was carried out by the Cotton Inspector in the Georgetown and Colonarie districts. Cotton stalks were destroyed on many estates, but it will not be possible to get the work finished this season before April 30. Arrangements have been made for the shipment of 7 tons of yams to Grenada for planting purposes. A local Syndicate has arranged to purchase and refine the crude cotton-seed oil produced by the Government Ginnery. Mr. S. C. Harland, Scientific Assistant for Cotton Research, returned from Barbados on March 26, and resumed his duties at the Experiment Station. The weather during the month was fairly dry. The rainfall recorded at the Botanic Station was 7·53 inches and at the Experiment Station, 5·79 inches.

ST. LUCIA. According to notes received from the Agricultural Superintendent, operations in the Experiment Station during the month of March, in addition to the usual routine work, included the making of farine, reaping of cassava and potatoes, and the preparation of dried potato chips, and making of flour. Plant distribution comprised the following: limes 950, oranges 8, decorative and economic 294, vegetable seeds 64 packets. The reaping of cacao and sugar-canes continues, but the lime crop is practically over. Mr. Brooks states that large areas are being cleared for planting limes. The Government Granary and Provisions Depot, which continues to be largely patronized by the general public, has now undertaken to supply all ground provisions required by the public institutions. Work in connexion with the Cacao Prize Holdings Scheme was continued throughout the month. The rainfall registered at the Botanic Gardens Castries, during the month totalled 5·82 inches, and at the Agricultural and Botanic Station, Choiseul, 4·68 inches.

ST. KITTS. During the month of March plant distribution was a follows: cane plants, 3,300; peanuts, 20lb. In addition, 1,270 lb. of selected cotton seed were sold. Cuttings of seven varieties of cassava, and tubers of seven varieties of yams were sent to the Agricultural Department, Grenada. Operations in the Botanic Gardens were of a routine nature.

Regarding staple crops, the Superintendent of Agriculture, Mr. F. R. Shepherd, states that the cane crop is being rapidly taken off, and there is little to report in this connexion beyond the general short tonnage per acre. The general condition of the young cane crop is reported as unsatisfactory. Cotton is being planted on estates to the north, and the lands in the Valley district were being prepared for planting during this month. The acreage seems likely to be increased. All available selected seed from the Experiment Station has been sold. The lands at LaGuérite, rented for the growing of ground provisions, are being planted chiefly in sweet potatoes. Certain estates are allotting lands to the labourers for the purpose of growing provisions. The rainfall for the month was 3·38 inches; for the year, 8·74 inches.

NEVIS. Mr. W. I. Howell, Agricultural Instructor, states that on account of the dry weather experienced in

March, the crops in the Experiment Station were making very slow progress. Plant distribution during the month included 1,650 onion slips, 9,000 sweet potato cuttings, 16lb. seed corn (maize), 597lb. selected cotton seed, and 1 lb. of Guinea corn. Concerning staple crops it is mentioned that the young canes throughout the island are very poor, and in some places the germination has been very bad. Reaping of the old crop is still in progress. Cotton lands have nearly all been prepared, and planting has been done on a few estates, but in consequence of the dry weather germination has been poor, and the crop is making little progress. Regret is expressed that old fields of cotton are still found standing about the island. Prevailing weather conditions also affected the planting of provision crops in the lowlands. In the highlands, however, where the weather is not so dry, there is a fair acreage of provisions planted, and the crops are doing fairly well in these parts. The rainfall for the month was 2·75 inches; for the year to date, 8·20 inches.

VIRGIN ISLANDS. Mr. W. C. Fishlock, Curator, mentions a continuation of dry weather during the month of March, which prevented cultural operations to any extent. Plant distribution was limited to 4,600 onion seedlings. The condition of the cotton crop is not satisfactory, dry weather and pests having considerably reduced the anticipated yield. Leaf-blister mite was observed in all districts visited. The attempt to revive the Tortola Onion Growers' Association has been abandoned, consequent on the lack of interest shown at two meetings held with that object. The rainfall recorded at the Botonic Station, Tortola, during the month totalled 1·60 inches, as compared with an average of 2·41 inches for the same month for the preceding seventeen years.

BERRIES, OLD AND NEW.

A very widely distributed order of plants throughout the tropics is known as the Myrtle family (Myrtaceae). Of the many thousands of species grouped under this order nearly all are natives of the tropics, either of the Old or New World. It is true that the common myrtle, from which the order takes its name, and the pomegranate, another member of the order, probably originated in the subtemperate regions of Western Asia. Another genus of the order (Eucalyptus), now widely spread throughout the warmer portions of the world, is indigenous in its many species to Australia. To this order belongs several tropical edible berries, the best known of which is probably the guava, (*Psidium guayava*). Attention has been drawn in previous numbers of the *Agricultural News* to two other members of this family, the Jaboticaba (*Myrciaria cauliflora*) of Brazil, and the pine-apple guava (*Feijoa sellowiana*), as being possibly desirable introductions to these islands. In fact we have been informed that specimens of Jaboticaba are now growing in the Botanic Garden, Dominica.

Another genus of this order (Eugenia) comprises several hundred species, some of which are indigenous to the West Indies, and some have been introduced for the sake of their edible berries into these islands from tropical Asia. Amongst the latter are the Malacca apple (*Eugenia malaccensis*), the pomme de rose or rose apple (*E. Jambos*), and the Java plum (*E. javanensis*), all of which are natives of the East Indian Archipelago. Among the native Eugenias there are some which are also esteemed as fruit, such as *E. uniflora* (the Surinam cherry), *E. procera* (the black cherry), and *E. floribunda* (the guava berry of the Virgin Islands).

In common with most of the members of the order the Eugenias are distinguished for generally possessing pungent, aromatic flavours and odours. As is the case with most tropical berries, no attentiou has ever been paid to improving their qualities by hybridization or selection, and yet many of them possess most agreeable flavours. By the introduction of other species of the genus, and judicious hybridization, it may be possible for horticulturists to produce superior varieties in the future.

The Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture, in the inventory of seeds imported during 1914, makes mention of several apparently desirable species of Eugenia originating in Brazil, which might be found to be so well adapted to West Indian conditions as to be an addition to our somewhat scanty list of refreshing berry fruit. *Eugenia dombeyi*, called in Brazil 'Grumichama', both for its ornamental value and its fruit, seems specially worthy of trial. The tree grows to 25 or 30 feet in height, well shaped, and thickly covered with glossy, deep-green foliage. In general appearance the fruits very much resemble cherries. They are round or slightly flattened, and of a deep crimson colour. The thin skin encloses a soft, tender pulp of mild and delicate flavour, containing from one to three rounded small seeds. Mr. Dorsett, the Department's collector in Brazil, says that the Grumichama is one of the most agreeable myrtaceous fruits which he has tasted.

Another of these Brazilian Eugenias is *E. luschnathiana*. Mr. Dorsett procured seeds of this fruit from near Bahia, where it is called by the natives, 'Pitomba.' He describes the tree as a very handsome, compact tree of from 20 to 30 feet in height. The fruits, which are produced on the small branches, are about 1 inch in length and $\frac{7}{8}$ inch in breadth on an average. The colour of the fruit is deep orange yellow when fully ripe, with a thin and easily broken skin enclosing a soft, melting pulp, bright orange in colour, very juicy, and of an acid aromatic flavour. The tree does not produce as heavy a crop as the Grumichama, but the fruit is especially esteemed for making jellies and jams, it being somewhat acid when eaten raw. It is a vigorous and easily grown tree, and might probably be successfully grown in the tropics of the northern hemisphere.

A larger fruited Eugenia is *E. klotzschiana*, known in Brazil as 'pera do campo,' which means field pear. This is not a tree, but a shrub, growing to the height of 4 to 5 feet, with very few branches. The fruits are strikingly similar in appearance to a small russet pear. They vary from 2 to 3 inches in length, and are russet-brown in colour, with a thick down on the suface; the skin is thin, and surrounds a whitish, very juicy and aromatic pulp, so fragant that it can he smelt several yards away. The flavour is rather acid, but very aromatic. Mr. Dorsett considers that this shrub seems, on the whole unusually promising for trial in the warmer parts of the United States. He calls attention to three other species of Brazilian Eugenias which he thinks worthy of trial in other tropical regions. He describes *E. campestris* as a small, highly ornamental tree, which bears small, yellow, rather acid fruits, which are appreciated by the natives. Another small tree is *E. myrcianthes* which produces oblong, purplish-red fruits about the size of an olive, with greenish flesh. It is said to bear profusely, but the fruits are rather hard when ripe, and for this reason are usually crushed into a paste before eaten. The third species is *E. speciosa*, which is a large, much branched tree, the fruit of which is said to be of value.

Perhaps some of our horticulturists in the West Indies might interest themselves to obtain, and make experiments with one or more of these new species of Eugenia.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
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Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The benefit which would probably be derived by the cacao planter from paying attention to the qualities desired by manufacturers of cacao, is discussed in the editorial.

Under Insect Notes, on page 138, will be found the conclusion of the article on fleas and their control, the first part of which appeared in our last issue.

The nature of akee poisoning, many cases of which have recently occurred in Jamaica, is the subject of an article on page 139.

On page 143 will be found an account of educational functions which Botanic Gardens may perform.

Breeding Cane Varieties on Mendelian Lines.

In an article on scientific progress in sugar cultivation in Java contributed to the *International Sugar Journal*, February 1918, Dr. Prinsen Geerligs draws attention to the fact that in former times the raising of cane varieties had more the character of a lottery than of a scientific, thought-out plan. If a good variety had been obtained, no one could trace back its origin. In order to remedy this haphazard proceeding, the experiment station in Java is now raising seedling canes on Mendelian principles, and carefully recording the cross-fertilization of canes from different varieties. If by this methodical research a new variety is evolved which combines excellent qualities, this cane may at any time be reproduced by following the lines laid down in the plan for its production, and noted down in the records of the station. Up to the present the scientists of the station have not yet raised a variety which may be considered superior to the excellent ones now in cultivation, but they are confident of attaining their aim, and presenting the Java planters, not only with a good, sound, superior cane, but also with the recipe to get the same cane again, if through misfortune it should deteriorate after the lapse of some years.

The Peanut Crop in the United States.

According to the *World Wide Magazine* of Montreal, February 16, 1918, the ravages of the boll weevil have forced the cotton growers of the Southern States to turn their attention to other crops, among which the peanut has risen to prominence.

It was estimated that the peanut crop in the United States in 1908 was worth $12,000,000. The valuation of this year's crop is put as probably more than $60,000,000. In Texas alone there are 200,000 acres planted in peanuts.

The high food value of the nut and the oil extracted from it has been often emphasized in this Journal. The article referred to above states that peanut oil can be extracted in the same mills by the same machinery that turns out cotton-seed oil. This is a great advantage in districts where cotton is largely cultivated. The cotton-seed mills have a capacity beyond the available supply of their raw material, and therefore lie idle for a large part of the year. Now that the machinery of these mills, with but slight adjustment, can be turned into peanut-oil plants, they will naturally welcome the new industry that will extend the yearly period of operation, and at the same time increase the profits on their working.

In addition to the valuable products derived from peanuts, they are, like other leguminous plants, of great benefit in enriching the soil in which they are grown.

The planters of the Southern States realize that there is considerable profit to be derived from the cultivation of peanuts, so that the acreage in Texas under this crop has increased more than 1,000 per cent. from 1915 to 1916. In that State it is estimated that

the peanut and the cotton crop will this year be about equal in value.

Special machines have been invented to deal with the crop in every stage of its progress. The peanuts are dug, cleaned, bunched, and placed on the mill by machinery.

A Clever Device to Crack Palm Nuts.

The *West India Committee Circular* for March 21, 1918, draws attention to a recent American invention for cracking the hard shells of palm nuts produced in Mexico and Central America, solely by centrifugal force. The machine is shaped somewhat like a drum, and measures 6 feet in diameter. Its height, when the top feed and bottom discharge appliances are added, is nearly 7 feet; it weighs approximately 6,000 lb.

The nuts are conveyed in a steady stream to the hopper at the top, and from the hopper they drop into a fast revolving drum wheel which throws them with great force against a continuous stationary belt of breaker blocks lining the inside surface of the main drum-shaped casting.

A pressure of about 1,800 lb. is required to crack them, as the nuts have an extremely hard shell, about ½-inch thick. The drum wheel turning on a perpendicular set axle is speeded to 800 revolutions per minute, and hurls the nut on a tangent a distance of but 2 feet. This force is sufficient to break the shells into several pieces, and to release the kernels. Deflected by the downward sloping surface of the breaker block, the kernels and hulls drop toward the bottom of the machine, where they enter a discharge pipe, and are separated from each other by a system of blowers. The machine has a capacity of dealing with about 10 tons of nuts per hour.

The difficulty experienced heretofore in preparing these nuts for the market has been in the matter of cracking the hard inner shell. In Mexico this work is ordinarily done by hand, and is tedious and slow work. This machine solves the problem very advantageously, not only because of the greater speed, but because in cracking the nuts by centrifugal force the kernels for the most part remain whole, and do not lose any of their oil.

Wood or Candle-Nut Oil.

The following memorandum has been received from Mr. A. W. Hill, Assistant Director of the Royal Botanic Gardens, Kew, with reference to this subject as noticed in the *Agricultural News*, January 26, 1918:—

'Of the limited number of species of Aleurites as already referred to in the *Kew Bulletin*, *Aleurites Fordii*, Hemsl., is a native of the Central Provinces of China, South-western Province of Yunnan, and northwards to the borders of Eastern Tibet; *A. montana*, Wilson, of South-eastern China; *A. cordata*, R. Br., of Southern Japan; *A. triloba*, Forst. (*A. moluccana*, Wild.) of Polynesia and Malaya—widely distributed in the tropics; *A. trisperma*, Blanco, native of the Philippine Islands.

'It would seem, therefore, that although *Aleurites triloba* may not be regarded at the present time the most important commercially, or the best in its drying properties, it is clearly a valuable source of oil, and the best plant of the series to rely on for cultivation in tropical countries—warm temperate or subtropical regions being apparently more suited to the other species (excepting *A. trisperma*) mentioned above, and perhaps they would succeed on some of the higher elevations of the West Indies.

'*Aleurites trisperma* might also be tried. According to *Kew Bulletin* (1908, p. 93), the native names in the Philippines are "Balocanad", "Baguilumban", "Calumban", and "Balucanag", and "the oil, which is regarded as poisonous, is perhaps superior to Chinese Wood-oil in its drying properties."'

A. triloba attains a considerable size and fruits well in Dominica. Specimens exist in most of the islands. There is a small plot in Nevis, planted by the late J. S. Hollings, which was in good order when last reported on.

Potato Butter.

The following recipe appeared in *The Times*, January 9, 1918, and seems worthy of attention by housekeepers in these days of short butter supply.

'The Ministry of Food states that in view of the shortage of butter they have been carrying out experiments in order to find suitable and economical ways of eking out the available butter and margarine supplies by mixing in other food substances, and so producing cheap and polatable substitutes. These experiments have shown that an excellent "potato butter" costing only about 5*d.* per lb. (or less if margarine is used) can easily be made in any household without special knowledge or apparatus in accordance with the following recipe:—

"Peel the potatoes and boil (or steam) until they fall to pieces and become floury. Rub through a fine sieve into a large basin which has been previously warmed. To every 14 oz. of mashed potato add 2 oz. of butter or margarine and one teaspoonful of salt. Stir thoroughly with the back of a wooden spoon until the whole is quite smooth. The butter may then be made up into pounds or half-pounds, and kept in a cool place."

'The potato butter may be improved in appearance by the addition of a few drops of butter colouring, and if it is to be kept for more than a few days, butter preservative, of which there are several forms on the market, should be used. The amount should be in accordance with the printed instructions on the packet for use in butter. Both the colouring and the preservative should be well mixed into the potato at the same time as the butter and salt. If these directions are carefully followed, potato butter will keep for a considerable time, though it may be found that the surface is apt to become dry, but this can be obviated by keeping it wrapped in grease-proof paper.'

INSECT NOTES.

FLEAS AND THEIR CONTROL.

(*Concluded.*)

There are certain general principles in the control of fleas which can be applied to nearly all species, with certain modifications for the different species and for the different conditions under which they live. It was pointed out in the last number of the *Agricultural News* that the cat and dog fleas and the human flea are the most important species invading houses. It was also noted that the adult fleas feed more or less on cats and dogs, while the younger stages develop in the cracks of floors and beneath houses.

Two main measures of control are therefore required to keep down fleas in houses: first, the destruction on the hosts of the adult fleas which lay the eggs; and secondly, the cleaning up of the immature stages which develop in or under houses.

HOW TO KILL FLEAS ON CATS AND DOGS.

For killing fleas on cats and dogs the writer* recommends giving the animals a thorough washing in a tub containing one of the so-called 'stock dips'. This is usually a saponified coal tar creosote preparation, and should be used in the proper proportions. The animal should be scrubbed thoroughly, special attention being paid to the head whither many of the fleas rush to avoid the bath. With dogs the solution may be allowed to dry on the animal, but in the case of cats, especially if tender-skinned, the preparation should be washed out of the fur soon after the animal is removed from the bath.

An alternative bath of kerosene emulsion may be used in the following proportions: dissolve 2 oz. of washing soap in 1 quart of hot water, and when boiling remove from fire and add 2½ pints of kerosene. This mixture must be beaten up thoroughly, until a creaming mass is formed in which there is no free oil. Then add water to make 5 gallons. It is important that no kerosene should separate, since free oil is injurious to animals.

Cats and dogs may also be rid of fleas by treating them with powdered naphthalene, or with pyrethrum powder. Either of these can be carefully rubbed into the hair of the animal. Both of these materials stupefy the fleas, and make them come to the surface or drop out entirely. This treatment can be given on papers spread on the flour, and the naphthalene can thus be recovered and used again.

It is important to note that the skin of cats is much more susceptible to injury by chemicals than that of dogs; hence any preparation used should be weaker when used on cats than on dogs.

HOW TO DESTROY FLEAS IN IMMATURE STAGES.

In addition to ridding infested animals of adult fleas it is essential to destroy the younger stages which are constantly developing to the adult stage, and reinfesting animals and annoying man. The breeding of the immature stages usually takes place in the cracks of floors or under carpets or matting, or in rooms which are not swept frequently, and which may be visited by cats or dogs.

It is recommended that the carpets and rugs be removed, the floors thoroughly swept, and all the dust be burned, as this will contain the younger stages of fleas. Then the floor should be thoroughly scrubbed with strong soap suds. The floor coverings should be properly aired and beaten before being replaced. Powdered alum can be sprinkled about, or papers dipped in an alum solution can be placed under the rugs.

Another method of destroying fleas in houses is to scatter 5 lb. of naphthalene flakes over the floor, and close all doors and windows for twenty-four hours. The naphthalene can be swept from room to room. In extreme cases fumigation with sulphur fumes or with hydrocyanic acid gas is sometimes employed. If sulphur is used, it is necessary to remove metal objects and potted plants, as the gas given off by the burning sulphur corrodes metals and injures plants. Hydrocyanic acid gas should only be used under competent direction, as this gas is highly dangerous.

It sometimes happens that fleas breed beneath or around houses, which are thus constantly reinfested from outside. In cases of this sort it is necessary to clean up all the refuse and burn it. Then common salt should be sprinkled about freely and thoroughly soaked. Additional wettings should be given at intervals, if necessary.

Various substances are used as repellents for keeping fleas away from bedding, but these are only temporary measures. The most effective way of keeping fleas in check is to destroy the immature stages in their breading places, and the adult fleas on their host animals, as described above

Mention may be made here of the control of the sticktight or chicken flea, which also sometimes infests cats and dogs.

All animals, and poultry as well, should be prevented from resting beneath houses or barns, as fleas breed favourably in such places, and these are difficult to treat if they become infested. Chicken houses and places frequented by poultry should be thoroughly cleaned, and the breading places of fleas should be sprinkled with crude oil, or salt should be scattered about and then wet thoroughly. Fowls should not be allowed to eat the salt as it is poisonous to them.

It is not an easy matter to destroy the sticktight flea on fowls without injuring the bird, but in the case of heavy infestations, the clusters of fleas about the head can be treated with carbolated vaseline or with a mixture of kerosene and lard—1 part of kerosene to 2 parts lard. Cats and dogs can be treated in the manner described above for ordinary fleas. Rats are sometimes infested with the chicken flea, and the control of these animals will also help to keep down this flea.

Flea bites can be treated with such substances as menthol, camphor, or carbolated vaseline, which will serve to relieve the irritation. A 3-per cent. solution of carbolic acid in water is also beneficial.

J.C.H.

*F. C. Bishopp, *Farmers' Bulletin 897*, U.S. Department of Agriculture.

The original form of banana must have been of little value as a fruit, judging from the present wild species. It has been therefore concluded that it was first used by mankind as a root crop, the roots even yet being used as an article of food by the natives of some tropical regions, while the tender heart of the stem is used for the same purpose in Abyssinia to-day. Under cultivation the banana probably began to produce better fruits, and such varieties were probably selected as desirable for reproduction. (The *Journal of Heredity*, Vol. V, p. 273.)

AKEE POISON.

From articles and correspondence in recent numbers of the Jamaica *Gleaner* we gather that there have been so many fatal cases of what was commonly called 'vomiting sickness', especially in the parish of Trelawny, that the Government Bacteriologist, Dr. H. H. Scott, was especially commissioned to investigate the matter. He reports most definitely that the cause of the complaint is akee poisoning. In a lecture reported in the *Gleaner* of March 19, 1918, Dr. Scott explained the matter, and we reproduce some of his remarks as of general interest; for although the akee (*Blighia sapida*) is not a very common tree in the other islands of the West Indies, it is grown here and there, and the fruit is used for food. We have never heard, however, in these other islands, of the evidently dangerous practice of using as soup the water in which the akees have been boiled; it is always thrown away. It may be mentioned that in Barbados the akee is called 'fig nut', while the well-known 'genip' (*Melicocca bijuga*) which is a harmless, if rather tasteless fruit, and is eaten raw, is known as 'akee'.

Blighia sapida is a native of tropical West Africa, whence it was carried by a slave ship to Jamaica. The edible portion of the fruit consists of the white, fleshy arils which surround the black shiny seeds for two-thirds of their length. In appearance this aril is strongly suggestive of the sweetbread of a calf.

Dr. Scott states that unopened and immature akees as well as over-ripe ones are to be strictly avoided. He insists that the akee, if incautiously gathered when immature, and if improperly prepared, is a deadly poison, killing oftentimes so rapidly that, unless taken under control at once, it gives no second chance, and may sweep away a family in a day; but that if they are ripened naturally, and properly prepared, they are, as far as he is aware, wholesome at all seasons, and excellent food.

Dr. Scott says that the poison present in akees belongs to a very obscure group of very poisonous substances known as phytalbumoses and tox-albumins. These are soluble in water, and are precipitated by alcohol; they kill rapidly; they probably break down readily to form other bodies, and in attempting to extract them for tests they become transformed into other products, and are thus very difficult to identify. Other members of this group of poisons are ricin, which is present in the castor oil bean (*Ricinus communis*), and abrin, an extremely toxic substance present in the seeds of the 'jumbee bead' (*Abrus precatorius*). These substances are a very obscure subject in physiological and chemical botany.

In allusion to the epidemic character of the disease in Jamaica, Dr. Scott says that the period corresponds exactly with the main akee season, when other fruits and foodstuffs are relatively scarce. During the present epidemic the number of cases has been highest where the scarcity was most marked. In Trelawny district, as the result of the hurricane, there was practically very little but akees, and the poor people had been almost living on them.

The symptoms following akee poisoning are vomiting followed by rapid recovery if the dose is small, but if large, and in solution as in the water in which akees are boiled, absorption is too quick, and after the first vomiting there is a quiescent interval, a return of vomiting, with drowsiness, coma, and death.

Dr. Scott emphasizes as a precaution that the water in which akees have been boiled should be thrown away, and further, that akees should be boiled separately from other articles of food. We may also state that it is most unadvisable to eat akees raw.

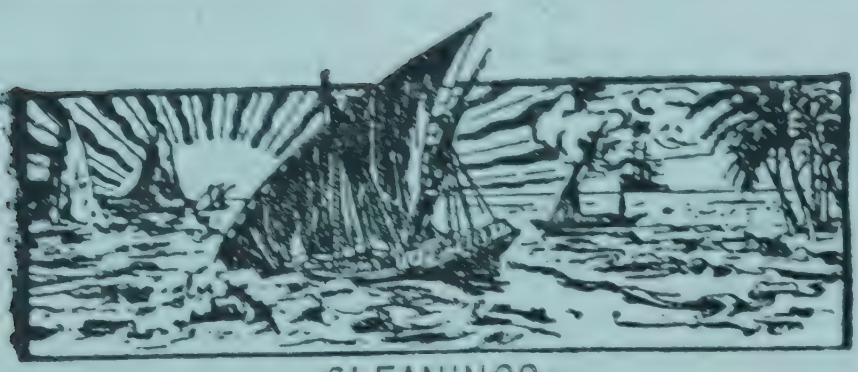
THE EXCHANGE OF USEFUL PLANTS.

A free interchange of knowledge and material has widely extended the application of the products of the plant world to the needs of mankind. Travellers have not only conveyed from one country to another knowledge and experience gained at home, but have also brought back fresh information which can be turned to useful account. An article in the *Field*, February 16, 1918 points out that the United States has established a system of world exploration with respect to plants which cannot fail eventually to enrich America. A branch of the Department of Agriculture, known as the Office of Foreign Seed and Plant Introduction, is devoted to obtaining from other countries such plants as have an economic value, and which may be suitable for cultivation in some part or other of the territories of the United States. Experts are sent out to explore and collect, and their collections are propagated and distributed free of charge to cultivators who are willing to experiment with them. Bulletins giving helpful information respecting the plants thus distributed are published from time to time, and reports on results obtained are invited for the guidance of others.

The Head of the department, Mr. David Fairchild, in a paper recently read before the Pan-American Scientific Congress, dealt with this question of the exchange of useful plants between one country and another. As instances of the benefits resulting from this exchange, it may be mentioned that the civilized world is indebted to Peru for the potato, now the staple food of many countries; and from the same country the tomato is a comparatively recent addition to the food-plants of the world. From Peru also cinchona, from which quinine is produced, has come. The plant that supplies most of the rubber used in the world is a native of Brazil; cacao is a South American tree; tea comes from China; coffee from Arabia—these are a few of the plants which now largely contribute to the health and welfare of mankind. The largest grain crops of the world, grown wherever suitable, are maize, a native of America, and rice which comes from China, while the interchange of fruit from one place to another is one of the most striking features of modern horticulture.

Under the auspices of the United States Department of Agriculture, experiments on a very large scale are being conducted with many different kinds of exotic fruit and plants. The persimmon (*Diospyros kaki*), which in China and Japan is what the apple is in Europe, is being extensively experimented with in the United States, hundreds of thousands of trees of it having been planted. The long-lived, large-fruited Chinese varieties are expected to prove most serviceable, as their fruit contains no tannin. In the south of France this fruit seems to flourish well. It may be mentioned that efforts have been made from time to time to introduce it into some of the West Indian islands, but hitherto these have not met with any success. Another tropical fruit, the introduction of which in quite recent years into California and Florida has proved most successful, is the avocado pear. Other tropical fruit trees like the cherimoya (*Anona cherimolia*) and the jujube (*Zizyphus jujuba*) are being experimented with, in the belief that they may be grown on a large scale, and add to the food resources of America.

Mr. Fairchild believes that every country should have its government institution of plant introduction, gathering together material for cultivators and breeders to work upon, and that the results should be freely distributed as 'gifts from one country to another.'



GLEANINGS.

H. M. Consul at Para reports that the quantity of cacao exported from the State of Para, and Amazonas during the year 1917, amounted to 4,621 tons, as compared with 3,314 tons in 1916. The 1917 export was the largest for the last eight years. (*The Board of Trade Journal*, March 21, 1918.)

Use of horse meat by the people of the United States is increasing rapidly, despite of widespread sentiments against its use for human consumption. Horse meat retails for half the price of beef, and is palatable and wholesome. It can scarcely be distinguished from beef by the average buyer. (The *Kansas Industrialist*, March 27, 1918.)

The *Louisiana Planter*, March 30, 1918, states that it appears to be evident that there will be more or less of a reduction in the acreage under cane in Louisiana for the present year, especially in the south-western part of the sugar district. A considerable area of cane land will be put into rice, and some into cotton.

From the Report of the Commissioner of Agriculture and Labour of Porto Rico, it appears that the Entomologists of the Department have found that two plant bugs which are quite injurious to tobacco in that island are new to science. The life-history of the more important one has been worked out with methods for its control.

The tea industry in Nyasaland is steadily prospering, and the crop exported finds a ready sale in the London market at about 1*s.* per lb., which price, with the low cost of production, leaves a good margin of profit. The export of tea for the financial year 1916-17 amounted to 420,615 lb., the local value being £14,022. The acreage increased from 4,141 acres in the previous year to 4,228. (*Colonial Reports* —Annual, No. 955.)

A comparison of average analyses of sea-weed from the New England coast, New York horse manure, and cow manure with litter shows that the average sea-weed contains less organic matter, nitrogen, and phosphoric acid than the horse manure, and that it has about the same amount of nitrogen, much less phosphoric acid, and more potash than the cow manure. Seaweeds are relatively deficient in phosphoric acid. (The *Experiment Station Record*, Vol. XXXVII, No. 9.)

The *Botanical Journal* for March 1918 has the following notice. 'We are sorry to announce that the Council of the Royal Botanic Society finds it necessary, to its great regret, to suspend for a time the issue of the *Botanical Journal*. The cost of printing and paper, added to the other difficulties with which the Society is faced, renders it manifestly impossible to continue publication at the present price, and it will not be renewed until circumstances become normal.'

The cattle so long described as Holsteins have no connexion whatever with the German province of that name. They are exclusively from Dutch Friesland. British breeders have at last decided to describe the breed correctly. The use of the term Holstein was always a misnomer, and has in recent years become offensive. In future, this famous milking breed of the Netherlands is to be known in England—and let us hope in other countries—as Friesian. (The *Field*, March 9, 1918.)

The American Consul at Rio de Janeiro states that there is a possibility of Brazil's developing a large industry of its native vegetable fibres. One of the most promising of these appears to be that of the Piteira (*Fourcroya cabuya*), because of its adaptability to the making of sacks for bagging coffee. Potash and wood alcohol are said to be available bye-products, thus helping to lessen the actual cost of extracting the fibre. From 2 to 3 per cent. of the weight of the leaves is said to consist of fibre. (The *Colonizer*, March 1918.)

For the successful culture of roses, it is recommended in *Bulletin No. 190* of the University of Illinois Agricultural Experiment Station, that the nitrogen content of the soil should be maintained by turning under, before planting, green or farm manure in preference to commercial fertilizers. If roses show signs of nitrogen starvation—a lightening of the colour of the foliage—make application of liquid manure, mulches of manure, or top dressings of dried blood, the last not exceeding 5lb. per 100 square feet, and applied not oftener than six weeks apart. Manure only during sunshiny weather, and most generously during periods of heavy flowering.

Before the American civil war Florida was looked upon as something of a sugar-producing State, with quite a fine promise for the growth of the sugar industry. The civil war stopped all this development, and the continual decline in prices of sugar, owing to the beet sugar competition in Europe, gradually destroyed the industry. It appears now that efforts are being made to resuscitate the sugar industry in Florida; and at Miami a movement is on foot to convert a large acreage of the Everglades into a sugar plantation. Many persons are reported to have consented to plant large acreages. One proprietor, it is said, will plant 1,000 acres of his Everglades land in sugar-cane, and will subscribe $50,000 towards the erection of a sugar factory. (The *Louisiana Planter*, March 30, 1918.)

The *Field* for March 9, 1918, states that Mr. Prothero, in an address to a meeting of agriculturists at Reading on March 2, made the following remarks which are worth attention in all parts of the Empire: 'In the present struggle the test was endurance. Food has become the most important of munitions of war. We had found leaden and silver bullets, and it is now up to the farmers and their labourers to find food bullets. Growing food was an insurance to save our own skin. If we were compelled through shortage of food to accept a victor's peace from Germany we should be skinned alive, and for many years to come every half-penny of profits we might bring out from the soil by the sweat of our brow would go to paying indemnity taxes. If the food line at home broke, it was of no use holding the trenches at the front.'

JAMAICA OIL OF ORANGE.

The editorial in the *Perfumery and Essential Oil Record*, March 1918, draws attention to the remarkable development of the production of orange oil in Jamaica in the last few years. Whereas the export to the United Kingdom, the United States, and Canada in 1911 was valued at nearly £10,000, in 1916 it had reached more than £141,000. It would seem as if the industry might be remunerative in some of the smaller islands, especially such an island as Dominica, where the écuelling of limes is largely practised, and where there is probably a glut of oranges at present, owing to shortage of shipping. The present price of Jamaica orange oil on the London market is from 8*s.* to 9*s.* per lb.

The initiation of the extraction of the oil from oranges in Jamaica, notwithstanding the abundance of the fruits grown in the island, is of comparatively recent date. The first experiments appear to have been induced by the heavy tariff against citrus fruits imposed by the United States, and the distance of Jamaica from other large consuming centres. Small headway seems to have been made until the Sicilian earthquake of 1908 paralysed for a time the industry in the Mediterranean island, and gave a splendid opportunity to introduce the West Indian oil, which is now firmly established on the markets. In addition to its use in the United Kingdom and on the Continent, Jamaican oil of orange has a big sale in the United States, where it is largely employed in the manufacture of wafer biscuits, and in cakes and confectionery; this, of course, is in addition to that consumed in perfumery, soaps, and flavouring essences. The main method of preparation in vogue in Jamaica is a variety of the écuelle process of Southern Europe, although we believe that distillation was formerly and may still be to some extent employed. The actual apparatus, the 'rinder', is somewhat simpler than the Sicilian écuelle, in fact it seems almost identical with the écuelle used in Dominica for lime oil extraction. It consists of a shallow copper basin, coated with tin and studded with sharp copper points about ¾-inch in length. At the bottom of the 'rinder' is a receptacle to collect the oil, in the form of a funnel spout, the larger end opening into the basin, and the smaller being closed. The 'rinder' is held between the knees of the operator, and the orange is lightly rubbed by the palm of the hand against the spikes, which rupture the oil cells. When the receiver is filled, the oil is strained through a cloth into a bottle, and permitted to settle, so that it can be drawn off from the mucilage and juice with which it is usually contaminated. It is then filtered into tin-lined copper or tin vessels. Women and children do the actual rinding. The oranges are not, as in Florida and Sicily, grown in groves, but are in scattered plantations, and the oil is extracted on the spot, and carried to the merchants. The fruits should be fully grown, but not fully ripe, and the best yields of oil are obtained in the early morning before full sun power develops. About 2,000 fruits will give 2lb of oil. Jamaica orange oil was formerly crudely adulterated with kerosene and cotton oil, but this short-sighted practice has now nearly disappeared.

The prices obtained fluctuate somewhat, and are dependent not only on the demand for the oil, but on the size of the orange crop, and the outlet for the fruits for export. Thus a poor orange crop in America will favour a big enquiry for Jamaica oranges, and militate against oil production, with consequent raising of the price. The greater part of the Jamaica oil is from sweet oranges, and this commands a rather better price than that from the bitter variety, which does not accord with relative values of the two grades of the Sicilian product.

THE VALUE OF WATER HYACINTHS AS A FERTILIZER.

The apparent resemblance of the flower of *Eichornia crassipes* to that of the European hyacinth is responsible for its ordinary English name; no botanical relation however exists between the two plants. *Eichornia crassipes* belongs to the botanical family Pontederiaceae. It is a native of South America, but has become a troublesome weed in other countries, notably Florida, Indo-China, Australia, and India. It was introduced into these countries, as it has been into many of the West Indian islands, for ornamental purposes. The plant normally floats on the surface of the water, with abundant sub-aqueous roots. It has also large, bladder-like leaf-stalks which make it remarkably buoyant. It multiplies extensively by division of the root-stalks, and soon becomes a pest by forming such a dense mass of vegetation in canals and slow-flowing rivers, as to render navigation impossible. The means to be taken to exterminate it in India is the subject of *Bulletin No. 71* of the Agricultural Research Institute, Pusa. In Burma, the pest has become so widespread that it has been found necessary to legislate against it: the object of the bulletin is to indicate that a certain return can be obtained from the plant in the process of exterminating it. Its extermination and not its commercial exploitation is aimed at; but it is thought that efforts to get rid of it may be more energetic if some return is obtained for the labour involved. In Indo-China investigations have been carried out towards finding an economic use of the weed, such as the manufacture of paper, and the extraction of salts of ammonium It has also been proposed to employ the fibrous matter of the plant for the manufacture of bags. No commercial successful enterprise has as yet been elaborated. In this bulletin the matter is approached from an agricultural standpoint. From the analyses of specimens of the plant it appears that the water hyacinth contains considerable stores of valuable plant food, of which potash is the chief constituent. If rotted, the residue contains about the same amount of nitrogen and phosphoric acid as, perhaps rather more than, ordinary farmyard manure; and it is several times as rich in potash.

The fresh green plant contains about 95 per cent. of water, and could not be economically transported over any great distance. The rotted plant contains about 60 per cent. of water, comparable with cow dung in this respect.

The dried material is only about one-twentieth of the weight of the green plant: it is thus in a much more convenient form for transport than either the green plant or the rotted material. It contains from 1·5 to 2 per cent. of nitrogen, and about 8 per cent. of potash.

After burning, the ash residue of clean plants unmixed with earth has been found to contain as much as 35 per cent. of potash. The ash is therefore several times richer in potash than ordinary wood-ashes.

The results of a series of field tests on a jute crop showed conclusively that water hyacinth is a valuable manure, either in the rotted state or as ash, on various types of soil. On high, light, well-drained soils the rotted material might be preferable, but on heavy low-lying lands the ash would probably be more successful.

There are indications that the cultivators in the Dacca district of Bengal are beginning to appreciate the manurial possibilities of water hyacinths; and in a densely populated tract like Eastern Bengal, where one of the staple crops like jute responds to heavy potash manuring, there is a powerful incentive for the people to extirpate this obstruction of their water ways, either individual or collectively.

PLANT DISEASES.

INFECTION OF ORANGE FRUIT THROUGH BUG PUNCTURES.

The sweet orange has to be added to the list of fruits serving as hosts for the fungi associated with the internal boll disease of cotton bolls. Part of an orange purchased in Barbados, and reputed to have come from Grenada, was handed over to the writer by the Acting Scientific Assistant as having a peculiar flavour. Most of the segments were intact, and in each of them there were in the pulp near the surface of the fruit one or more regions in which about a dozen juice cells were collapsed and slightly browned. In each of these spots was found a prolific culture of *Nematospora* sp., the species D of the writer's papers on internal boll disease. The rind of the orange had been thrown away, but there can be little doubt, from analogy with other fruits, and from the absence of any visible lesion other than a slight scar on the surface of the segments, that the infection had been introduced by the punctures of some plant-feeding bug.

W.N.

AGRICULTURAL RESOURCES OF JAMAICA.

In an article dealing with the economical development of the island, which appeared in the Jamaica *Gleaner*, March 8, 1918, the writer seems to be very hopeful of the future. Portions of the article are reproduced below.

'The session of the Legislative Council, and the meeting of the island's representatives to discuss and decide on some definite programme for developing, let us hope, not only sugar, but the other economic resources of this island, is apparently a healthy sign that the old policy of laissez faire is now about to give place to the doctrine of preparedness.

'Apart from the unrest that has manifested itself during the past years, there are many reasons why the period of settling down to peace conditions should be a difficult one. On the top of the dislocation of industrial life, will come the necessity for increased production, which must be achieved by improved organization and methods, rather than by adding to the strain of the workers. The outlook causes anxiety to most thinking people, lest the end of the war should find the old relations between employers and employed still existing. All suggested solutions come back to a complete understanding and harmonious co-operation between capital and labour. Something more will be required than simply good-will—there must be definite schemes, which will enable employers to take labour into their confidence, and improve their social and financial positions, as capital and labour must work hand in hand and be in sympathy one with the other.

'Assuming, therefore, that employers and employed will adjust all their differences, and reasonable, substantial inducements be offered to the workers to retain their services at home, and thus stem the present tide of immigration to alien countries to earn wages on which they can with some comfort exist; then, the presence here of Sir Francis Watts, the Imperial Commissioner of Agriculture, may be advantageous in settling, once and for all, whether the Government are going to give financial help in starting sugar centrals, in such districts where cane can be successfully grown.

'I think that the views of the Right Honourable the Secretary of State for the Colonies in a recent despatch to His Excellency the Govenor, are those that should be carefully considered; inter alia, he writes:—

"It is most desirable that any scheme of central factory development should be co-operative. . . . I should prefer to see at least a part of the capital required for the factory provided by the planters: the larger their stake in the success of the factory, the better. . . . If the Government finds practically the whole of the capital, or guarantees a loan, I fail to see any convincing reasons for limiting its interests in the factory for a term of years, and handing it over to the planters at the end of that term."

'But, is sugar the only product to be developed! Surely we should also turn our attention to a variety of other products, minor as well as major. Why not start factories for manufacturing banana flour, kilns for drying corn, and the necessary machinery for grinding the same, both important factors of food supply—then sisal and henequen plantations may be started under the same auspices; similarly the cultivation of rice could be materially extended; the best varieties of the breadfruit and avocado pear should be grown by the Government, and seedlings distributed broadcast through the country gratis to every landowner, large or small. Factories also for curing salt beef and pork should command serious attention, and there is no reason why condensed milk could not also be manufactured here.

'And last, though not least, the technical staff of our agricultural department should be considerably strengthened and better paid, and should have added to it a mining geologist, and an expert on forestry, and an experimental station specially organized for study and research.

'These are the days of science; rule of thumb methods are the fetish of the ignorant, and as Adam Smith in his 'Wealth of Nations says, "Science is the great antidote for the poison of superstition."

'Let us therefore be firm at this juncture, and insist that all our economic resources capable of development be exploited as a whole, and not any particular one of them to the detriment of the others.'

AGRICULTURAL INSTRUCTION IN CANADA.

Under the above title there has been published, by direction of the Canadian Minister of Agriculture, a review of the work performed by the different provinces of Canada with the moneys granted under the Agricultural Instruction Act during the four-year period 1913-17.

Under this Act, passed by the Parliament of Canada in 1913, the sum of $10,000,000 was set apart for expenditure by the provinces on agricultural instruction and demonstration during the ten years ending March 31, 1923. Four years of the period have now elapsed, and $3,400,000 has been distributed among the provinces for the benefit of agriculture. With the year 1917-18 the grants to the provinces (which have have been made on a gradually ascending scale) reached the maximum, there to remain until the completion of the period. A summary of the work accomplished hitherto is therefore now published.

The purpose of the Agricultural Instruction Act is, in brief, to assist the provinces by grants of money to carry on educational and instructional work for the benefit and

encouragement of agriculture. This work is classified under four divisions:—

(1) The teaching in the public schools of the first principles of the sciences relating to agriculture;

(2) The teaching of more advanced agriculture in agricultural schools and colleges, devoting attention more particularly to the training of teachers, investigators, and community leaders;

(3) The carrying on of extension work, having for its object the instruction of farmers by acquainting them, through demonstrations and other means, with the results of scientific investigation and research;

(4) The amelioration of the conditions of rural life, particularly in so far as women and children were concerned.

In all the provinces the developments contemplated by the Act made necessary the employment of an increased staff of instructors, demonstrators, and superintendents. Deficiencies noted have to a great extent been remedied with the funds supplied. No province can now claim, on financial grounds, to be handicapped by inability to secure the men and material equipment necessary to the successful carrying on of the work.

The following is a brief outline of the nature of the work performed in the different provinces in making effective the intention of the Act.

In Ontaria, the District Representative system has been greatly extended, building equipment has been provided at the Ontario Agricultural College, and the teaching of agriculture in the public schools has been facilitated.

In Quebec, a large sum has been allotted to the teaching of approved methods of agriculture to the farming population, the colleges and schools of agriculture have received assistance for increased building accommodation and for the maintenance of their teaching staff, and the teaching of agriculture and domestic science in schools and academes has been given considerable aid.

In Manitoba, the Extension Service of the Agricultural College, embodying boys' and girls' club work, home economic societies, and agricultural short courses, has been greatly extended.

In Saskatchewan, the teaching staff of the College of Agriculture has been strengthened in order to enable that institution to qualify men for agricultural leadership, to conduct research work, and to promote college extention.

Alberta has been assisted in the equipment and maintenance of three schools of agriculture and household science, designed to supply a form of education adapted to the needs of boys and girls from the farm.

Instructional work among the farmers in British Columbia has been greatly extended, and the movement to establish the teaching of agricultural and domestic science in schools is entirely due to the assistance given by the grant.

In the Province of Nova Scotia, about 45 per cent. of all the work done under the Department of Agriculture, including the Agricultural College, may be credited, in so far as it is represented by moneys expended, to the Federal grant.

In new Brunswick and Prince Edward Island, there were practically no facilities for agricultural instruction at the time the Act went into effect. Schools of Agriculture and other necessary buildings and equipment have been provided; trained instructors have been secured; the interests of farm women have been promoted; while the teaching of the agriculture in the public schools has been greatly advanced with the funds placed at the disposal of these provinces.

As to the efficiency with which the work has been carried out, and as to the qualities of the results, it is difficult, in so wide a field, to speak except in general terms. In a number of instances the work has suffered from the loss of trained agriculturists due to the war, and indirectly in other ways from the same cause In the main, however, the conclusions are distinctly favourable, and the results will be, it is believed, still more apparent as time goes on.

EDUCATIONAL COURSES IN BOTANIC GARDENS.

In the editorial of the *Agricultural News*, March 23, 1918, it was pointed out that Botanic Gardens might perform a real educational function, if the imparting of *knowledge* and not merely dissemination of *information* was the object aimed at.

The *Journal of the New York Botanical Garden*, February 1918, contains the outline of a scheme by which the staff of the garden in Bronx Park are evidently endeavouring to fulfil this educational purpose in a practical way. Two courses in gardening are offered to the public. The first is called 'Simple Home Garden Courses' for those desiring to conduct their own gardens. It consists of 'talks' on soil and its preparation; cultivation and weed control; what and how to plant and transplant; food values of garden crops, and the relation of sunlight, air, and water to the garden. Along with these 'talks' garden practice and observation are insisted on with regard to all the ordinary operations of a garden. The course is planned for four months, one day a week, from March to June inclusive, and the fee charged is $5, which is to include necessary supplies and materials.

The second course is called 'Training Courses for Teachers for School Gardens.' There are thirty lectures of one hour each, and thirty hours of garden practice, together with thirty hours of labaratory and garden practice. The course extends, on various days, from April 1 to August 16. The fee charged is $25, which will include necessary materials and supplies, and laboratory and garden tools are also supplied without charge.

This course will show the pedagogical value of the school garden, and how it may fit into the curriculum without disturbing it.

How, by proper planning, a teacher may take a full class into the garden and do effective work in the ordinary class period.

How the garden will furnish material of educational value, alive with interest, which will aid and inspire the regular class-room studies of reading, writing, arithmetic, language, drawing, geography, and hisiory.

Instruction will be given by lectures, practice work, and reading, in those subjects needed by teachers in school garden work, and connected with class-room experiments.

The New York Botanical Gardens in Bronx Park have a reputation for the researches carried out there, and this educational move is likely to add to their reputation and effectiveness.

According to the St. Thomas newspaper, *Lightbourn's Mail Notes*, March 16, a new industry has just been started in Tortola. It is stated that an American has begun sponge fishing at the North Sound of that island, and it is reported that a fine lot of sponges have already been gathered and are being cured. It is to be hoped that this undertaking will prove a commercial success.

MARKET REPORTS.

London.—The West India Committee Circular, March 21.

Arrowroot—No quotations.
Balata—Venezuelan Block, 3/4; Sheet, 3/11 to 4/1.
Beeswax—No quotations.
Cacao—Trinidad, 95 -; Grenada, no quotations; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 3/3.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—2/9 to 3/9.
Nutmegs—1/7 to 2 4.
Pimento—5¾*d*.
Rubber—Para, fine hard, 2 8½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., March 27.

Cacao—Venezuelan, $13·25 to $13·75 Trinidad, $13·50 to $14·00.
Coco-nut Oil—$1·36 per gallon.
Coffee—Venezuelan, 11c. to 12c. per ℔.
Copra—$8·00 per 100 ℔.
Dhal—$14·00.
Onions—$8·00 per 100 ℔.
Peas, Split—$11·50 to $12·00 per bag.
Potatoes—English, $6·00 per 100 ℔.
Rice—Yellow, $12·00 to $12·25; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., April 3.

Cacao—Caracas, 13½c. to 14c.; Grenada, 14c. to 14½c.; Trinidad, 14¼c.; to 14¾c. Jamaica, 13¼c.
Coco-nuts—Jamaica selects, $58·00 to $60·00; Trinidad selects, $55·00 to $56·00; culls, $22·00 to $30·00 per M.
Coffee—Jamaica, 10c. to 12c. per ℔.
Ginger—15½c. to 20c. per ℔.
Goat Skins—Jamaica, 75c.; Antigua and Barbados, 75c.; St. Thomas and St. Kitts, 75c. per ℔.
Grape Fruit—Jamaica, $2·75 to $3·00 per box.
Limes—$13·00 to $13·50 per brl.
Mace—36c. to 40c. per ℔.
Nutmegs—23c.
Oranges—$5·00. to $7·00
Pimento—6¾c. to 7½c. per ℔.
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A FORTNIGHTLY REVIEW

OF THE

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Uniformity in the Production of Cacao.

IN the editorial of the last issue of this journal it was pointed out that if cacao growers desire to obtain the highest possible price for their product, the chief thing to aim at is uniformity in the quality of the beans, as that is what the manufacturers most require.

An instance of this is the reputation that Guayaquil cacao bears on the English market. From information received from the Imperial Institute it appears that the production of such a grade of cacao within the British Empire is much desired, the cacao manufacturers having stated that they are prepared to support any effort made in this direction by continued orders for a definite quantity. From this information, and from the description of the cacao cultivation in Ecuador by Dr. van Hall in his book *Cocoa*, it appears that the cacao plantations in Ecuador are distinguished by the uniformity of the types grown in different districts, as compared with the mixture to be found in West Indian plantations even in the same field.

Cacao beans of various types exhibit varying characters of 'body', flavour, and aroma, and these various qualities are made use of by manufacturers in producing blends which are usually put on the market under the names of the different makers. One can easily understand, therefore, that manufacturers are desirous of being able to obtain uniform lots of the qualities they require, so as to enable them to make their blends with accuracy.

There have been several plans suggested for the attainment by any given estate or district of a standard product of cacao, which might be definitely relied on as of uniform quality. The simplest of these is the plan suggested in Surinam, to which attention was drawn in the *Agricultural News* for December 29, 1917.

This plan is to carefully examine and label the trees on a plantation, and then gradually to eliminate those which are proved to be undesirable, replacing them with others of the type required. With the present almost universal custom of raising cacao trees from seed a difficulty arises here. With the existing mixed types of trees on cacao plantations it is

quite impossible to guarantee the propagation of any desirable variety by seed, as there are no pure strains which can be depended upon to breed true. All sorts of varieties may arise from seed of a most desirable type of tree, the pods and beans of which may show characteristics in the next generation differing in the most essential respects. Some of them might be taken to be almost pure Criollo, others various types of Forastero, and still others resembling low-bred Calabacillo. It would appear therefore that the effort to attain uniformity of product in cacao by seedling propagation must necessarily result at the best in very partial and by no means permanent success.

Another method which was forcibly advocated by the late Mr. Hart of Trinidad in his book, *Cacao, its Cultivation and Curing*, is by employment of grafting and budding. He truly remarks that:—

'The difference which an "even sample" would make to the seller is obvious. We know that it can only be obtained by means of grafting and budding from selected trees, or, as some would call it, by vegetative reproduction, in contradistinction to seminal reproduction. It is clear that once a tree has been selected and largely propagated by grafting because of its possession of superlative qualities, the produce of those trees must be of an even character, and that, taken year by year, the crop will vary but very little in general quality. By using the process of grafting, the planter will be able to secure trees of one habit, pods of one colour, and beans of the very best quality. Such beans, when cured, would be immensely superior to any produce harvested from seedling trees. To adopt grafting as a regular practice upon a cacao estate would be to adopt a method the benefit of which has been proved ages ago to the agricultural and horticultural world.'

It is thus evident that by selecting trees producing the type of bean which the planter has determined upon he can by degrees bring his plantation up to a perfectly uniform standard as to the beans produced by the trees, by resorting to budding or grafting in the replacing of the undesirable trees eliminated.

Valuable work has been done in experimentation on budding and grafting cacao by Mr. J. Jones, Agricultural Superintendent, Dominica. In 1908 he read a paper at the West Indian Agricultural Conference, held in Barbados, on the successful results he had obtained in Dominica in grafting cacao by the approach method. This paper was published in the *West Indian Bulletin*, Vol. VIII. In the Annual Report on the Agricultural Department, Dominica, 1913-14, Mr. Jones gave an account—reprinted in the *West Indian Bulletin*, Vol. XIV—of further successful experiments in budding cacao by various methods. He states in this report that he obtained the greatest percentage of successes by employing the well-known system of patch budding. Reference to these papers will repay any cacao planter who cares to try the methods described, which, it may be said, Mr. Hart in his book declared to be by no means difficult to carry out.

In order, however, to guarantee his product to the manufacturers the planter will have to be careful in the first place to pick only really ripe pods, and also to submit the beans to one uniform process of drying and sweating. He may then confidently expect that he will obtain the best market price for his dependable article. In every kind of merchandise the market is always commanded by standard products.

In viewing the mixture of types of plants to be met with on a cacao estate, one is drawn to consider whether there may not be the possibility of fixing pure strains from field selections or after scientific crossing on Mendelian lines, as has been done, for instance, in the case of cotton. This requires the attention of special investigators, and considerable patience, in order to be sure of the accuracy of the results obtained. Unfortunately for impatient men, cacao usually takes four to five years to begin bearing, so that it might require ten, fifteen or twenty years for a sufficient number of generations to be studied in order that the results might be definitely considered as trustworthy. It may not be too much to hope, however, that work on these lines may be provided for by some central research committee of similar constitution to that now concerned with cotton. It is probably the real solution of the question how to obtain and preserve uniformity in the production of cacao.

Although stress has been laid in the foregoing remarks upon the vital necessity of securing uniformity in the quality of the yield of cacao plantations, the question of obtaining greater quantity per acre is also of importance. The two questions by no means conflict. As in the matter of quality there is an extraordinary difference at present in the product of cacao trees planted in the same field, so also there is to be noted a very great difference in the amount of yield comparing tree with tree. In this direction there is the same

uncertainty involved in selecting seed for planting from trees which are known to be consistently heavy producers, and multiplication of the type by grafting or budding would certainly be more efficacious. That increased production can be secured by careful atention to details of cultivation and manuring must be evident, but that question is outside the scope of the present article. The review of a series of manurial experiments on cacao, conducted for a period of seventeen years in Dominica by Mr. J. Jones, appears in the *West Indian Bulletin*, Vol. XVI, No. 4, which has just been issued. This may be consulted with advantage by those interested in the matter.

SORGHUMS IN QUEENSLAND.

The value of the sorghums, known in the West Indies generally as Guinea corn and imphee, has often been pointed out in the pages of this journal. It would seem from a communication sent us by the London correspondent of the *North Queensland Register*, that their cultivation is receiving much attention in that country. He says that even in a drought year in Kingaroy district, when part of the maize crop failed completely, grain sorghum yields were consistently good, over 30 bushels per acre being obtained, bearing out the oft-reiterated statement that this group of plants is highly drought-resistant, and one of the surest grain crops under adverse conditions. In the summer of 1915, out of seven grain sorghums tried in the Boonah district, one gave a return of 50 bushels per acre, and the others ranged from 76 to 103 bushels, illustrating that high yields are procurable under good seasonable conditions. Special exhibits have been made each year at the National Show by the Agricultural Department to popularize these sorghums, and to bring them before the public with a view to their utilization as human food, and for maintaining stock, and as fattening food for pigs. Dairymen usually prefer the saccharine sorghums, but the non-saccharine varieties also make valuable green fodder and ensilage. Last year's results in the central district, in fodder and grain, of both groups of sorghum, have been very encouraging, grain yields of four kinds ranging from 64 to 80 bushels per acre.

The Advisory Council of Science and Industry has latterly been carrying out an investigation of the commercial possibilities of the production of power alcohol from saccharine sorghums. The matter of utilizing grain sorghums for a similar purpose was brought up at the recent Commonwealth Agricultural Conference, and if the investigations prove satisfactory, a wide field will be opened up in Queensland for the successful production of this crop, apart altogether from its value as a source of human and stock food.

FARMING IN AUSTRALIA FOR DISCHARGED SOLDIERS.

The following communication has been received at this Office from Mr. H. A. Davies, Australia House, London, with a request for its publication. This we are glad to accede to, as the subject is of importance to the whole Empire. It may also be noticed in this connexion that some of these West Indian islands, in which there are undeveloped lands, such as Trinidad and St. Lucia, have also taken steps on similar lines.

'Australia has wasted no time in the preparation of comprehensive land settlement schemes for soldiers. Within a few months of the outbreak of war the problem of placing the men on suitable areas after their service ended was tackled by public men, and the merits of various schemes inquired into. The Commonwealth Government intends to set aside a total of £32,000,000 for repatriation, and various State schemes are already in operation.

'British soldiers and sailors will be interested in the scheme lately adopted by the Government of Queensland. Land comprising 234,300 acres has already been set aside, and negotiations are in progress for the occupation of other areas. Within the meaning of the "Discharged Soldiers Settlement Act" which deals with the subject, a "discharged soldier" not only includes members of the Australian Imperial Forces, but any person who has joined the forces of the United Kingdom during the war, and who has received an honourable discharge. The terms may be extended so as to include members of His Majesty's forces during the present war from any part of the British Empire, or members of the allied forces who have received their discharge before their arrival in Queensland. The term also includes the dependants of any such soldier, in the event of his death before he receives his discharge, or within a period of twelve months after he has received it.

'Portions of the land set aside have already been cleared and planted, and a varied assortment of farming pursuits are recommended, such as pine-apple growing, poultry raising, bee keeping, apple, pear, peach, and plum orchards, dairy and sugar-cane farms. Liberal financial assistance will be given to settlers, particularly in the first years of their occupation.'

TROPICAL SOILS.

In the *Daily Argosy* of Demerara, April 23, 1918, there is a report of a general meeting of the Royal Agricultural and Commercial Society, held in Georgetown on April 17, at which the President, Professor J. B. Harrison, C.M.G., read the conclusion of his inaugural address.

After referring to the numerous analyses made by him on the soils of different lands in the colony, the Professor concluded that portion of his address with some striking remarks. He said that the commonly held view that the soils in the tropics were of very high fertility was directly contrary to the facts. The intensity of all chemical action in the tropics, and especially of oxidation and hydration, was opposed to the production of widely spreading areas of high alluvial and fluviatile plains, especially those which had been formed under swamp conditions. Such were the front lands and great areas of the lower river beds of the colony. The idea that tropical soils merely wanted tickling with a hoe to produce great and remunerative crops of economy plants was an error; tickling the soil in the tropics resulted in the production of immense crops of weeds. He was satisfied from nearly forty years' experience in connexion with tropical agriculture that permanent cultivation in the tropics required a higher degree of skill, and more persistent efforts than in temperate or subtropical lands. A training in an agricultural college in a central part in the West Indies, followed by practical work under an experienced planter, was the only way he knew by which the skill he had referred to could be obtained.

DOES MUTATION OCCUR IN GOSSYPIUM?

An interesting paper by Thomas H. Kearney, entitled 'A Plant Industry Based on Mutation' appears in the *Journal of Heredity* for February 1918. According to the author, experiments to determine whether Egyptian cotton could be grown in the United States were begun by the United States Department of Agriculture some twenty years ago.

Several introductions were made, the most important being by Mr. David Fairchild, who visited Egypt in 1899, and obtained seed of the principal varieties then grown in that country. This seed was tested by Dr. H. J. Webber at a number of stations in the southern and south-eastern States. All the varieties, when first introduced, were not only relatively late in ripening, and unfruitful, but were extremely variable. Plant breeding experiments were begun by Mr. Kearney at Yuma, Arizona, in 1903, with the variety Mit Afifi. Selection was carried on for several years, resulting in a gradual improvement in the uniformity, earliness and productivity, in the manner in which the bolls opened, and in length of the fibre. Up to this point no marked change of type was observed to have taken place.

A new era in the breeding work began in 1908, when two of the progeny rows were found to differ strikingly from the parent stock, and from one another. These rows gave rise to the Yuma and Somerton varieties. The Yuma variety was preserved, and became the basis of the Egyptian cotton industry in Arizona. This variety differed from the parent Mit Afifi in numerous characters, of which the most conspicuous were the longer (about $1\frac{1}{2}$ inches) and lighter-coloured fibre. Another variety, the Pima, was derived from Mit Afifi through Yuma. In 1910, in a field of Yuma cotton at Saccaton, Arizona, a plant was selected because of its superior productiveness and length of fibre. Upon examination of the remarkably uniform progeny row which was grown the following year from seed produced by this plant, it was evident that another new and very distinct variety had appeared. As compared with the parent variety (Yuma), Pima is distinguished by its fewer vegetative branches and better developed fruiting branches, by its plumper, more sharply pointed, and less deeply pitted bolls, and by its longer ($1\frac{5}{8}$ to $1\frac{3}{4}$ inches), finer, silkier, and lighter-coloured fibre.

The commercial production of Egyptian cotton in Arizona began in 1912, i.e., some thirteen years after the original experiments were initiated. In that year the United States Department of Agriculture supplied seed of the Yuma variety to planters in the Salt River Valley, and some 200 acres were planted.

From this small beginning the industry expanded, until in 1917, in the Salt River Valley alone, about 23,000 acres of Yuma cotton and about 7,000 acres of Pima cotton were grown, and the value to the farmers of the fibre and seed produced was estimated at about $5,000,000. The prospects are that in 1918 not less than 100,000 acres will be planted to this crop.

The fibre of both the Yuma and Pima varieties has found much favour with American spinners, the automobile tire manufacturers having shown especial interest in this product.

Here then, in brief, is the history of the development of the Egyptian cotton industry in the south-western United States. No one will grudge unstinted praise to the patient investigators who have built up such a flourishing industry, least of all any one familiar with the great difficulties inherent in cotton-breeding work.

But in the article under discussion, and in a former paper, Mr. Kearney has definitely committed himself to the view that the varieties Yuma and Pima have been developed from Mit Afifi by mutational origin, and it is upon his scientific opinions, and not on the economic results which have developed out of the work of himself and his associates, that the present writer wishes to offer some criticism.

First of all, what does Mr. Kearney mean by the term mutation? His own definition is as as follows: 'Mutation in plants may be defined as a type of variation manifesting itself in the sudden appearance of a distinctly different individual, the characters of which are uniformly expressed by its descendants when self-pollinated or cross-pollinated among themselves.' The meaning which we must attach to this statement is that a homozygous individual suddenly appears in (a) a mixture of homozygotes and heterozygotes, (b) a population of heterozygotes only, or (c) a population of homozygotes only.

Mr. Kearney rejects Johannsen's definition of mutation as a sudden discontinuous alteration of the biotype, independent of all crossing, because such a limitation of the term leaves us without a designation for the well-known cases which most biologists regard as the best examples of mutation, and which represent a distinct and important phenomenon, although probably to be interpreted as resulting from remote or complex hybridization.

Later, Mr. Kearney states that mutation manifests itself in the sudden appearance of an individual which differs from the parent stock in *one or more strongly heritable characters*. 'If this individual "breeds true," the new characters being uniformly expressed in its progeny generation after generation, a stable variety will have been produced.'

Now if Mr. Kearney can show that the behaviour of his new types of cotton conform to his first definition, he will accomplish a fine piece of scientific work, but he has not yet shown any such thing. He has expressed an opinion, but he has not backed up that opinion by any ordered collection of data which bear on it.

Further, Mr. Kearney's first definition of mutation seems to conflict with his second, for it appears that in the latter he is not concerned whether the other characters of the plant breed true or not. He only insists that the plant must be homozygous for the 'new characters'. How many new characters would be sufficient for a Kearney mutation? Would one be enough? If so, the appearance of single-comb fowls in F_2 of a cross between rose and pea-combed fowls would be a mutation, for it satisfies Mr. Kearney's definition very well.

Dr. Nilsson-Ehle, at the Svalöf Experiment Station, crossed two red-kernelled sorts of wheat. The F_1 was red-kernelled, but in the F_2 appeared some white-kernelled individuals which bred true in F_3. According to Mr. Kearney this would be a mutation, although it was explained quite simply by the hypothesis that each of the parents had its own peculiar unit for red colour. The cross was of the nature $R_1r_2 \times r_1R_2$. Thus $\frac{1}{16}$ of the F_2 would be constant $r_1\ r_2$ (white). In general the appearance of a new constant form ab in a cross aB × Ab—especially where aB and Ab were outwardly alike—would be hailed as a mutation, although such cases have been explained again and again quite simply in Mendelian terms.

Again, one is forced to ask for Mr. Kearney's evidence as to the purity of his 'mutants'. So far as the present

writer is aware, the only evidence that the 'mutants' were pure for the new characters is Mr. Kearney's assertion that such was the case. No geneticist would accept evidence so meagre, when such an important biological point has to be decided upon.

The mutants are said also to be comparable with those of *Oenothera Lamarckiana*, as described by de Vries. The scientific world owes a debt of gratitude to Professor J. P. Lotsy for his able criticism of the Lamarckiana question. He says: 'De Vries has shown that *O. Lamarckiana* is a heterozygote and he has shown nothing else; all the rest is mere hypothesis. . . . The behaviour of *O. Lamarckiana* gives not the slightest cause to suppose that the aberrant forms thrown by it owe their origin to a process of mutation; they can perfectly well be explained without resorting to an "explanation" lying outside the pale of experience, by the simple fact which the experiments that have been published all tend to show, viz., that *O. Lamarckiana* is a mixture of heterozygotes of different constitutions, throwing rogues (the pretended mutants) by a process of Mendelian segregation.'

In the same way no mutative hypothesis is necessary to explain Mr. Kearney's results. If, as he says, he does not think that they can be explained by the hypothesis of reconstruction of Mendelian factors, it is for him to demonstrate scientifically that this hypothesis is inapplicable.

S.C.H.

EXPERIMENTS IN SUGAR-CANE CULTIVATION IN ST. CROIX.

A series of experiments, designed to ascertain the relative value of planting canes on the flat or between banks, has been conducted for the last couple of years on the Slob Experimental Station, St. Croix. A report for the year 1917-18 by the Manager of the Experimental Station, Mr. Edward Gedde, has been forwarded to the Imperial Commissioner of Agriculture for the West Indies. From this it appears that after three years' experiments Mr. Gedde is quite convinced that, under similar conditions of rainfall and cultivation, the system of planting on the flat leads to a considerable increase in weight of canes reaped per acre, at least in plant canes. Experiments with green dressing, as compared with pen manure, have given somewhat inconclusive results, for when applied to canes cultivated on the flat, the green dressing led to a less yield than was obtained on the control plot to which no manure was applied, whereas pen manure, applied on the flat, led to a very large increase. On the banked field pen manure again produced the greatest yield, but green dressing produced almost 50 per cent. higher returns than were given by the unmanured plot. Another experiment with regard to pen manure of different conditions seems to show that pen manure mixed with turfy earth (Mr. Gedde does not say in what proportion) caused an appreciable increase of yield over that from plots manured either with pen manure from a covered pen, or with pen manure prepared in the open.

Although from experiments conducted in several of the smaller English islands, the cultivation of alfalfa as a forage crop has not appeared worth further trial, it would seem that in St. Croix alfalfa has succeeded fairly well. Mr. Gedde advises planters in St. Croix to cultivate it, at least to a small extent.

Further experiments on the rotation crops best suited for cultivation with sugar-cane, and as to the best distance apart for planting canes are being carried out. Another interesting series of experiments which Mr. Gedde has planned is one to investigate what difference, if any, will result from using as plants, (1) tops from plant canes only, (2) tops of first ratoons, (3) tops of old ratoons, and (4) plants of ripe cane joints.

CHEMICAL CONTROL IN SUGAR FACTORIES.

The importance of what may be termed an exact chemical audit of the working of sugar factories has been many times emphasized in this journal. An instance of this importance in the factories in Java is mentioned by Dr. Prinsen Geerligs in an article in the *International Sugar Journal*, February 1918. He says:

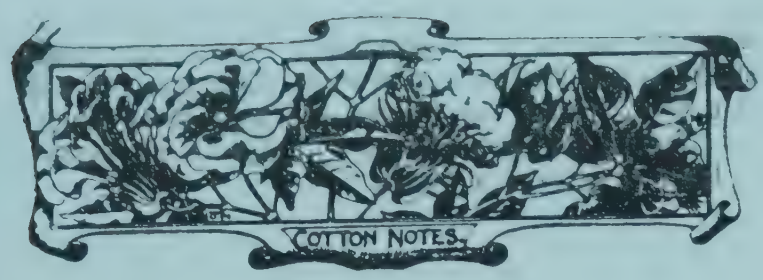
'It has been observed that the mill control, as required by the Experiment Station, was much too intricate and too troublesome for practical use, and that considerable simplification might be considered. The result of recent deliberations was, however, that the figures required were really necessary to obtain a good insight into the milling work, and that it was obligatory to collect these data in order to serve as a basis for improvement as soon as a falling-off in the efficiency of the mills was noticed.

'An example of the excellent results of careful mill control is given by the fact that large losses of sugar, which till recently escaped detection, are now brought to light by the close control.

'It was originally the custom to ascertain the amount of sugar in juice and in bagasse, and to consider the amount of sugar in cane to be the sum of these two, making no allowance for unaccountable losses during milling. The new control records the amount and the sugar content of the different mill juices separately, and that of the total of the mixed juice; and it found in many instances that the amount of sugar in the mixed juice was smaller than that of the sum of the component parts. This strange phenomenon could not be ascribed to a personal error, as the weighing and determinations were all made on the same scales, with the same instruments, and by the same individuals, and notwithstanding, always tended in the same direction. It was found that in the tanks, gutters, collectors, etc. of the juices, especially those of the maceration with last mill juice, such huge amounts of bacteria, yeasts, and fungi could accumulate, that large quantities of the sugar, amounting to as much as 6 per cent. of the total quantity, were lost by inversion. The new control can detect those losses, which may be rather easily overcome by continually cleaning the conducts through which the juices pass, or even by using double sets of tanks, suction pipes, collectors, etc., of which one set is cleaned and disinfected, while the other one is working. This rather simple device has already reduced these unaccountable losses in many factories to an insignificant fraction of their former sum, thereby proving that they had really existed, and were not a consequence of errors.'

DEPARTMENT NEWS.

News has been received that Sir Francis Watts, K.C.M.G., the Imperial Commissioner of Agriculture for the West Indies, has arrived at Nassau, Bahamas.



COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended April 6, 1918, is as follows:—

ISLANDS. We have no change to report in the market, which remains quiet with only limited inquiry. The Factors however continue unwilling to make any concessions in their asking prices, consequently we have to repeat our last quotations.

We quote, viz:—

Extra Fine 75c. to 80c. = 77c. to 82c., c.i.f.
Fine to Fully Fine 73½c. to 74c. = 75½c. to 76c. ,,
Fine to Fully Fine, off in preparation, 70c. to 71c. = 72c. to 73c., c.i.f.
Fine to Fully Fine, stained, 65c. to 68c. = 67c. to 70c., c.i.f.

GEORGIAS AND FLORIDAS. The market remains very quiet, with Factors willing sellers of average Extra Choice at 73c. but there is only limited inquiry and apparently no demand.

The exports consist largely of cotton held by the Government in Savannah and Jacksonville, which it is reported they forward to such mills as they have contracted with for material requiring this quality of cotton.

We quote, viz:—

Fancy	74c. = 76c.	c.i.f.
Average Extra Choice	73c. = 75c.	,,
Choice	72c. = 74c.	,,

The exports from Savannah for the week have been, to Northern Mills 527 bales, and from Jacksonville to Northern Mills 714 bales.

THE SUPPLY OF FINE COTTON.

The Empire Cotton Growing Committee, which was appointed last year by the Board of Trade, has issued a report on the fine cotton supply in the immediate future. This report published in *The Board of Trade Journal*, March 21, 1918, is of special interest to the British West Indies, where the finest cotton in the world is produced.

It is pointed out in the report that the tendency towards a diminished supply threatens to become more marked during the next year or two. The yield of the Egyptian crop has been falling somewhat steadily for some years past, and a very serious reduction is threatened in the Sea Island crop.

If the world's cotton supply is divided into five grades, the finest grade of all, the best Sea Island cotton, is a very small crop, but of very high value. It comes only from (1) certain small islands off the coast of South Carolina, and (2) from some of the British West Indies. The supply of this type of cotton before the war amounted to not more than 10,000 bales of 400 lb., and the value of the very best grades went as high at times as 40*d.* per lb. During the war the total Sea Island crop of this grade has shown a marked downward tendency. In 1916 the total was under 700,000 bales.

The best West Indian Sea Island cotton only represents about 20 per cent. of the West Indian crop, a further 50 per cent. is of the second grade, about the same quality as Florida and Georgia Sea Island, and the best Egyptian. The whole West Indian crop has suffered serious diminution since the war began. This has especially been noticeable in Barbados, where in 1913 there were 3,970 acres under this crop, but this fell to 1,078 acres in 1916. The reduction has been largely due to the competition of sugar at high war prices, tempting the planters to devote their attention entirely to the cultivation of sugar-cane. The future prospects of the crop depend largely on the relative prices of sugar and cotton, and though it is said that the area under cotton will be considerably increased, there is hardly any reason to hope for the return to the pre-war figures of the area under cotton for some years to come.

As regards the supply of the second grade cotton from Florida and Georgia, the extreme variation of the yield, coupled with the speculative character of the price, has done much to render the crop unpopular among the planters. For the year 1916-17 Florida and Georgia produced 110,000 bales of 400lb., while they are not expected to yield much more than 90,000 for 1917-18. The greatest factor in the diminution of the cultivation of Sea Island cotton in Florida and Georgia is the boll weevil, which has steadily been advancing from the Gulf States towards the Atlantic, and when once it arrives in the Sea Island districts there is every reason to believe that it will cause the complete abandonment of the cultivation of fine cotton. It must therefore be expected, as quite probable, that the American supply of both the first and second grades of fine cotton will be seriously reduced in 1918. It may be said that this reduction in American fine cotton will not seriously affect the British supplies, because for sometime past very little Sea Island cotton has been exported from America, the whole of the crop having been practically kept for the needs of American spinners; and British spinners have been dependent almost entirely upon the West Indian crop and the finer grades of Egyptian cotton.

In considering possible alternative sources of supply of fine cotton, there must be taken into account a remarkable development in irrigated districts of Arizona and California, where the cultivation of certain new types of cotton of Egyptian character has been introduced, and is being considerably extended. The crop of the present year has been estimated within the very wide limits of from 55,000 down to 13,000 bales, but even at the largest estimate the total amount of the crop would not be sufficient to replace the loss of the Florida and Georgia crops, even if its quality was of the same high grade.

The other quarter from which it might have been hoped that a largely increased supply of fine cotton might have been obtained is Egypt, but there, unfortunately, recent tendencies have been all in the wrong direction. The best Egyptian varieties are almost, though not quite, equal to the best Florida and Georgia Sea Island, but the quantity of these varieties was comparatively small. Of late, unfortunately, the tendency in Egyptian cotton has been towards deterioration, and it does not seem likely that any considerable increase in production of the best grades is to be looked for in the near future from Egypt.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and seventieth meeting of the Council of the British Cotton Growing Association was held at the Offices, 15 Cross Street, Manchester, on Tuesday the 9th. instant. In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.) Mr. R. J. Clegg occupied the Chair.

WEST AFRICA. The purchases of cotton in Lagos to March 31 amounted to 886 bales, as compared with 3,714 bales for the same period of last year, 4,201 bales for 1916, and 1,880 bales for 1915.

In Northern Nigeria the purchases to March 31 amounted to 2,142 bales, as compared with 3,353 bales for the same period of last year, 8,356 bales for 1916, and 229 bales for 1915.

The increased buying price which the Association have arranged to pay for this season's crop is welcomed by the natives, and should result in the farmers having every confidence in cultivating cotton, and in further increasing the area under cotton. The reports from Lagos all state that the season is a late one, as too much rain fell during the planting season, and in many cases, owing to this, the seed did not germinate; fortunately the Harmattan winds held off until late, which will give the late plantings a better chance of maturing.

It is expected that the crop of long stapled American cotton grown under the supervision of the Government Agricultural Department in the Zaria District of Northern Nigeria, will amount to about 1,000 bales; although this is less than had been expected, it is a great improvement on previous results, and will give ample seed for distribution for planting purposes another season. It is understood that this variety has done better under the unfavourable climatic conditions than the indigenous types. A number of regulations have been made by the Government, with a view to preventing a mixing of seed of this long stapled cotton with the native varieties, and it is hoped that these regulations will prove effective.

THE ANTIGUA CENTRAL SUGAR FACTORY.

The thirteenth annual report of the Directors of the Antigua Sugar Factory, Limited, for the year ended September 30, 1917, has been forwarded to the Imperial Commissioner of Agriculture for the West Indies. Besides the purely financial statement contained in the report, some observations with regard to the future of the cane sugar industry in Antigua will be useful and instructive to others interested in the questions involved.

In the first place, the total tonnage of canes dealt with during the year was 102,593 tons, derived from the following sources: the original contractors supplied 25,796 tons, for which £1 16*s.* per ton was paid including the bonus; new contractors supplied 71,172 tons of cane, for which £1 9*s.* 1*d.* per ton was paid including bonus; from peasants were bought 5,624 tons at the rate of 20*s.* 10*d.* per ton.

The report shows that the factory charges, which include such items as salaries and wages, repairs and taxes, were £3 18*s.* 5*d.* per ton of sugar made; railway transport charges were 18*s.* 3*d.* per ton of sugar; while administration charges were 2*s.* 9*d.* The number of tons of sugar made in 1917 was 11,705, and the total proceeds from this sugar and the molasses produced was £252,617. The total expenditure on the other hand was £184,560, thus leaving a surplus for division of somewhat more than £68,000.

It is evident that though the weather was not so favourable, nor the yield per acre so high as in the year 1916, it has again been a successful year for the company, as prices were better, and there was an increase of sucrose in the cane. The factory work has maintained, if not even surpassed, the high level it reached in 1916, as the following figures will show. The sucrose left in megass in 1916 was 3·01 per cent., in 1917 it was lowered to 2·66; the purity of juice in 1916 was 83·95, in 1917 it was increased to 84·78; the recovery of sucrose in 1916 was 84·48, it was 84·52 in 1917; the yield of sugar 96° in 1916 was 11·01, in 1917 it was 11·42.

The Directors remark that the grinding season was again unduly protracted to August 24. Estate managers have represented to the Directors that such a late finish of a crop has a very prejudicial effect on the following crop, and that one of the most important steps towards securing a heavier tonnage of cane per acre would be to finish by the end of June. This could be done if crop were begun not later than February 1, and if the same full reaping were carried out on Mondays and Tuesdays as on the later days of the week. With regard to this slacking off of work on Mondays and Tuesdays, which occurs probably only in Antigua, the Directors would urge estate managers to endeavour to bring about a change in this custom, in the interest of their estates, and in the interests of the labourers themselves also.

The question of higher wages has been met for the present by an adequate advance which the high prices for sugar have enabled the estates to make. For the prosperity of the island, however, the Directors point out that it is of the utmost importance to avoid a return later on to the low pre-war rates of wages, and important also that the pay of managers and overseers should not fall back again to the former low scale The risk of this would be removed, if heavier crops per acre could be produced. The improvement in the present recovery of sucrose in the factory, as compared with the average of the five years immediately preceding the war, is equivalent to giving the planters 2½ tons extra cane per acre. Proprietors and managers may be able to do as much by introducing improvements in methods of agriculture, and again, there is reason to hope that as much might also be brought about by the labourers giving full work on Mondays and Tuesdays, and further by their reducing holidays in crop time, thus enabling the reaping to be finished early. If all this could be successfully accomplished, it would be equivalent to an addition of 7½ tons of cane or £5 per acre (calculated at pre-war prices). After allowing for extra expenditure on many items necessary for increasing the crops, there would still be enough to maintain adequately all rates of pay.

The most notable feature of the crop statistics for 1917 of Rhodesia is the largely augmented area of land under cultivation, an increase of 46,092 acres being returned. Out of these no less than 28,503 were planted in maize as a grain crop. Without doubt the Imperial offer to purchase all maize produced acted as a stimulant to its cultivation. The total amount of land under maize for the year is returned as 203,150 acres, from which were reaped 938,130 bags of 200 lb. weight, giving an average yield of 4·62 bags per acre. (The *Rhodesia Agricultural Journal*, February 1918.)

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

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Entomologists	H. A. Ballou, M.Sc.† J. C. Hutson, B.A., Ph.D.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.††

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†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial discusses the methods of obtaining uniformity of product from cacao plantations.

Under Insect Notes, on page 154, will be found an article dealing with the question of the value of zoology, especially entomology, with regard to human welfare.

Sugar-cane diseases in the West Indies is the subject of the note under Plant Diseases on page 158.

The question of the occurrence of mutations in cotton, and the scientific meaning of the term is dealt with on page 148.

The 'West Indian Bulletin', Vol. XIV, No. 4.

This number of the *West Indian Bulletin*, completing Volume XVI, has just been issued. The first paper, on the diseases of sugar-cane in tropical and subtropical America, especially the West Indies, is a very comprehensive description by Mr. J. R. Johnston Pathologist of the Central Experiment Station, Cuba, of the various diseases affecting the sugar-cane in these regions, along with notes on the same subject contributed by the Mycologist of the Imperial Department of Agriculture, and other West Indian investigators of plant pathology. It is well illustrated by distinct drawings of various fungi. The second paper is the report on some pests and diseases affecting various crops in the West Indies during 1916, compiled from the reports of the principal local agricultural officers. In the third paper, Sir Francis Watts, the Imperial Commissioner of Agriculture for the West Indies, deals with the important subject of the liming of soils, especially under West Indian conditions, and in relation to some of the principal West Indian crops. Mr. Joseph Jones, Curator of the Botanic Garden and Experiment Station, Dominica, contributes the fourth paper on manurial experiments with cacao in Dominica. This is a review of a continued series of experiments for the last ten years, and therefore affords very reliable conclusions. The last paper in this number is the continuation of the studies on the genetics of crinkled dwarf rogues in Sea Island cotton, by Mr. S. C. Harland, Scientific Assistant for Cotton Research, attached to the Imperial Department of Agriculture.

Granaries in Jamaica.

Information has been received from the Imperial Commissioner of Agriculture for the West Indies that the Government of Jamaica has ordered machinery for two granaries of the St. Vincent type, and when these are erected, which it is hoped will be quite soon, the Government will undertake the buying of corn on profit-sharing lines in two or probably three districts. Active steps are being taken to encourage the cultivation of as great a variety as possible of food crops on the part of both large and small owners. In the first instance it is thought that it will be best to begin co-operative work in buying, storing, and distributing of food crops by dealing with corn; later on other crops may have attention, but most of these can be dealt with without drying; it is only the surplus in these cases that needs drying, and at present there is no great surplus.

The Jamaica *Gleaner*, April 19, 1918, reports a speech on this subject made by Sir Francis Watts at a meeting of the Board of Management of the Jamaica Agricultural Society. Sir Francis pointed out that the granaries proposed to be erected would be able to deal with 400 bushels of corn a day, and he believed that by the end of the second year it would be necessary to increase the number of granaries.

Agricultural and Industrial Exhibition in Trinidad.

The annual agricultural and industrial exhibition held by the co-operation of the Agricultural Society and the Board of Agriculture, and, to a lesser extent, the Horticultural Club, took place in Port-of-Spain on March 22, 1918.

The Acting Director of Agriculture, Mr. Freeman, in his speech at the opening of the Exhibition by His Excellency the Governor, is reported in the *Port-of Spain Gazette*, March 23, to have drawn attention to the dominant note of this year's exhibition; this was the question of the production of local foodstuffs. One of the greatest attractions of the show was the war-time garden, a plot of ground tilled in model fashion under the supervision of the Department of Agriculture. This was meant to show how much could be produced in yams, corn, cassava, etc. from a small piece of ground. There were besides exhibits by the Department of Agriculture showing the effort made by planters to obtain high production from small areas. The results showed that the gain was over 100 per cent. over haphazard methods. Attention was also directed to the use that can be made of ground provisions, and amongst these was the making of bread from them, which was recommended particularly to the small cultivator, who is accustomed to have his food made in his own household. The breads exhibited were obtained from the Governor of the Prisons, who had had them made from various meals supplied to him.

Among excellent exhibits of various local manufactures that of the Prison Department of various specimens of joinery, stone-cutting and other manual industries drew especial attention.

Naturally there were numerous exhibits of the products of the chief industries of the island, among which must be noticed coco-nut and cocoa butter, and prepared chocolate produced by a local manufacturer.

The reporter in the *Port-of-Spain Gazette* mentions the really fine exhibits of goats, mostly Toggenburg, showing a distinct improvement in the class of goats bred at present. Hogs seem to have been somewhat disappointing, and it is suggested that there is room for much further development in hog raising. The cattle were all of high class, an advance as far as quality is concerned, on past years. The exhibits of horses were but few, but were quite up to the level in quality compared with past years.

Embargo on the Importation of Green Limes into the United States.

Mr. J. Jones, Curator of the Botanic Garden, Dominica, reports that news was received in that island on April 15 that the United States Government had placed an embargo on the importation of green limes. This is a considerable blow to the lime industry in that island, for it means that, for the time being, a trade estimated at about £50,000 annually, ceases. Representations have been made with the hope that the United States Government may raise the embargo.

Another difficulty which the lime industry in Dominica appears to be confronted with, is that for the last two months there has been no market for ripe limes, and the future position is not at all clear in regard to this matter, which is of great importance, especially to peasant growers. During a good crop year it is probable that the peasants market from 70,000 to 75,000 barrels of ripe limes,—roughly one-fifth of the crop of the island. Last year, when high prices were obtained for green limes, and the usual prices for ripe limes, it is estimated that nearly £20,000 must have been paid to the peasants for their fruit. It will be seen, therefore, that this closing of the market is a serious matter.

The difficulty of the disposal of the ripe limes is owing largely to the want of shipping accommodation for the export of the raw juice for use as a beverage. The only other way of utilizing the ripe fruit is for making citrate of lime or concentrated lime juice. Again, on account of shipping difficulties, these products may have to be stored for a considerable time.

Sisal Cultivation in Antigua.

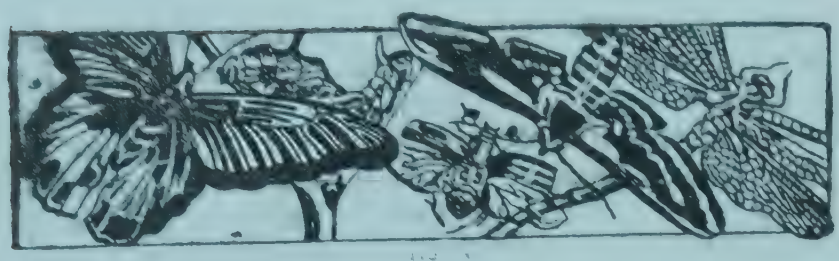
In a review of the report on the Agricultural Department, Antigua, for the year ended March 31, 1917, which appeared in the *Agricultural News* for March 9, 1918, attention was drawn to the fact that 8,000 sisal plants had been sent out from the Agricultural Station to plant 11 acres in the windward district in an attempt to establish a fibre industry in that drier part of the island. Mr. T. Jackson, the Agricultural Superintendent, has forwarded to this Office some notes on observations he made after paying a visit to the sisal cultivation.

He states that there are growing on the estate where the cultivation has been begun four varieties of agave: (1) the ordinary wild agave found in Antigua (*Agave Keratto*); (2) *Agave sisalana* (sisal); (3) *Agave fourcroydes* (henequen); and (4) an unnamed variety which occurs locally. The second and third of these varieties are the only ones which are valuable as a commercial source of fibre.

Mr. Jackson remarks that, although the plants have made very slow growth, their healthy appearance indicates that the conditions are, on the whole, such as to favour the success of the experiment.

With regard to the planting of sisal and henequen, Mr. Jackson observes that it is evident that the plants should not be set deeply in the soil, as is exemplified by the manner in which the wild agave grows. The lower leaves of the plants should never be covered by earth.

He also advises that, until the plants attain a considerable height, careful weeding around them by means of a scuffle hoe is necessary, the ordinary agricultural hoe not being suitable for the purpose; the land between the rows of plants he advises to be kept clean by occasional cutlassing.



INSECT NOTES.

THE VALUE OF ZOOLOGY TO HUMAN WELFARE.

The above title formed the subject for discussion by some of the leading zoologists of the United States at a special symposium held under the auspices of the American Association for the Advancement of Science during its last annual meeting at Pittsburg in December 1917. Each speaker had been assigned one general topic relating to that branch of zoology in which he himself is a specialist, and it was hoped that the contributions by the various speakers might more or less supplement each other. The present symposium was also intended to supplement a former discussion on the same general subject held at the Philadelphia meeting of the above Association in 1914-15. Since the time allotted to each speaker was necessarily limited, the various aspects of the subject could only be touched upon briefly by the different speakers. The whole subject is one of general interest, and some of the different topics will be referred to later.

Among the speakers on the present occasion was Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington, who discussed the subject from the point of view of the economic entomologist, and alluded to the 'work that those zoologists who study insects have done and are doing for the welfare of humanity.' A brief sketch of this paper, which was published in *Science* for April 1, 1918, is given here.

Dr. Howard begins by stating that the Class Insecta includes a host of species which are most keenly competing with the human species in the struggle for existence. Insects have their origin in an early period of the earth's history, dating back to Carboniferous or perhaps to Silurian times. They have persisted and flourished by adapting themselves to almost all conceivable conditions, until at the present time they are the chief competitors with the human race for the control of the earth.

The unceasing struggle between insects and man is vividly sketched in the following words: 'Man labours for months to produce a food crop—he must share it with many species of insects. He builds himself a house with infinite toil—it must harbor insects as well. He makes garments for himself—without great care on his part they are eaten by insects. His harvested food is destroyed by them; his blood is sucked by them; he sickens and dies from a multiplication of disease germs which they have introduced by their bites, or with which they have contaminated his food, and after his death they consume his body.'

The relations between insects and the food crops of man is then discussed by Dr. Howard. This subject has become one of vital importance at the present time. In peace times it was estimated that the damage caused by insects to the food products of the United States amounted to approximately $1,300,000 per year or roughly, about 10 per cent. of the whole. This estimate, as expressed in terms of money, is open to criticism, as Dr. Howard points out, for the obvious reason that a fall in production is followed by an increase in price. The loss, however, may be estimated just as well in terms of human food, and consequently of human vitality. The writer continues: 'A loss of 10 per cent. of the possible food, and not considering the question of waste, means strictly that a given number of people must live on a ration of 90 per cent. of the possible; not necessarily that 10 per cent. of the people must die of starvation.'

It has been estimated that the Bureau of Entomology saves the United States over $22,000,000 annually, but this estimate is probably far too small.

In addition to the insect enemies of growing crops there are a large number of species which attack stored food products of all kinds, and the problem of preserving stored foodstuffs from the attacks of insects has become of the greatest importance in the present crisis. As an instance of the importance of this question of food preservation from insects at the present time, the writer mentions that Mr. Maxwell-Lefroy has been sent from England to Australia to study the condition of the Australian wheat awaiting export to the United States, and to prevent damage by insects which attack stored grains. The United States has sent large supplies of milled grain to England, and in order to save the long transportation, the Australian wheat is to go direct to San Francisco for use in America. So that much depends on the success of Mr. Lefroy's work in Australia.

Dr. Howard then touches upon 'the enormous problem of medical zoology', in which the entomologist has a most important interest. 'It is true' he continues, 'that most of the important discoveries concerning the carriage of disease by insects have been made by medical men, and not by entomologists. But even in these cases, the discovery once made, the entomologist, with his training in methods of investigating the life-history and habits of insects, plays the important part in the investigation of every point in the life-history, habits, and behaviour of the insect carrier, and in the perfection of the methods for its destruction.'

The writer considers that the prevention of insect-borne diseases is a matter for the economic entomologist and not for the medical man; or at the very least, for the individual who does not yet exist, namely, the medical man trained as an entomologist. At present the entomologist forms a link between the medical man and the sanitary engineer.

J.C.H.

Investigation of Thymol Yield of Wild Thyme.—In the *Agricultural News*, April 20, 1918, a query was made as to the possible utility of *Coleus amboinicus*, known generally in the West Indies as wild thyme, as a source of thymol.

With reference to this subject Mr. A. E. Collens, Superintendent of Agriculture, Antigua, states that he investigated this plant, known in Trinidad as Spanish thyme, for thymol content at the Government Laboratory there in 1914. A reference to this appeared in the annual report of the Officer in Charge of Special Investigations for that year. The amount of oil recovered was too small for any definite investigation—the freshly gathered herb, which contained practically 90 per cent. of moisture, yielding less than 0·2 per cent. of oil. Mr. Collens goes on to say that it may perhaps still be of interest to examine local specimens, as the oil content may be considerably influenced by climatic conditions, and a comparatively dry climate, such as that of Antigua, may lead to an increased yield.

SIMPLE METHODS OF KEEPING FRUIT AND VEGETABLES FRESH.

Most of the ordinary methods for preserving fruit and vegetables involve a certain amount of cooking; that is to say, the fruits are not kept in a fresh condition. The following methods of keeping fruit and vegetables fresh for a long period are described in the *Wealth of India*, January 1918.

It is stated that if the fruit is not wanted to be kept for more than a month or so, tins with well fitting lids, perfectly clean and dry inside, should be provided. The fruit to be kept must be carefully examined, and any specimen showing the smallest sign of decay should be rejected. Every fruit should be ripe but not in the least degree over-ripe. Immerse the fruits for a moment in a bowl of water almost at boiling point. The moisture soon dries off, and then the fruits may be packed in the tins, which when closed should be put away in a cool place. The dipping in the scalding water is for the purpose of killing any germs of moulds which might be present on the skin of the fruit.

Another method advised is to pack the fruit with powdered cork. This material forms a protection against changes in temperature and variations in the amount of moisture in the atmosphere. In this case also, perfectly sound fruit should be selected, and wiped perfectly dry. A 2-inch layer of cork dust is to be spread on the bottom of a wooden box, and the fruit arranged on that, care being taken that no one fruit touches another. When the first layer is arranged, fill up all the spaces between the fruit with powdered cork, and cover the first layer with another inch of the material. Proceed in the same way until the box is filled. It is claimed that fruit and vegetables treated in this manner will keep fresh for a year. When taken out the fruit need only be dipped into water to remove the cork dust.

Sawdust has been tried in the same way, but it is not entirely satisfactory, owing probably to the fact that it is difficult to obtain sawdust absolutely free of moisture.

It is said that experiments in this direction, conducted in France, have shown that fine sand is of value for the purpose. The sand must be perfectly clean, and in order to render it so it is necessary to subject it to several washings. After washing, the sand must be completely dried by sun heat, or artificial warmth. Each specimen of fruit or vegetable to be preserved should be wrapped in thin paper, and packed in a box with the sand in the same manner as with cork dust. Most vegetables, and all kind of fruit, except soft berries, can be treated in this way, and are found to keep their flavour and aroma for a long time. When required for use the preserved articles are simply washed with plain water.

Another plan, which is stated to be especially useful in dealing with apples and pears, and which would seem to be just as suitable for dealing with many tropical fruits, is described as follows: Prepare a solution in the proportion of 1lb. of resin, 1oz. tallow, and 1oz. bees-wax. Put these into an iron saucepan, and melt slowly over a fire, taking care that the mixture does not boil. Each fruit must then be separately rubbed over with whiting or precipitated chalk. In order to dip the fruits into the hot mixture a small pointed stick should be inserted into each. After dipping, hold the fruit in the air for a moment, that the thin coating of the solution may set firm. The wooden chip should not be pulled out, as that would leave an unprotected spot. The coated fruit may then be put away on shelves or in boxes, and when they are required for use, it is only necessary to crack the coating and peel it off. It is claimed that fruit thus hermetically sealed up are beautifully preserved for a considerable time.

It must be remembered that when fruit has been preserved in any of these methods, it is important that it should not be kept too long after removal from the box in which it has been stored. After any process of preserving, fruit when exposed again to the air will decay more rapidly than when it has been freshly gathered.

THE DEMAND FOR CASTOR OIL.

During the last couple of years considerable attention has been directed to increasing the production of castor oil. According to the *Eastern Morning News*, April 10, 1918, Hull has for many years been practically the only centre in the United Kingdom where castor oil is dealt with. The great expansion of the aeroplane industry has resulted in a greatly increased demand for castor oil for lubricant purposes, because it has the special advantage of not freezing at low temperatures. Its value therefore in the high altitudes to which aeroplanes soar is obvious.

Up to the present, India has been the largest producer of castor seed in the world, its export of seed being estimated at 100,000 tons annually, together with 2,000,000 gallons of oil. Now, however, attention is being given to the cultivation of the seed in other places. Since the entry of the United States into the war, with the programme of building an enormous number of aeroplanes for military purposes, there has been a necessity of providing a sufficient supply of castor oil for their use. It is said that in some of the western States, where the seed has been already cultivated, there has been no less than 100,000 additional acres put under this crop.

Attention is also being paid to the possibilities of castor oil cultivation in these West Indian islands. The Agricultural Department of Trinidad has published information with regard to this subject, and the notice of agriculturists in Jamaica has also been drawn in several issues of the *Journal of the Jamaica Agricultural Society* to the possibilities of the remunerative nature of the crop.

The *Revista de Agricultura*, February 1918, which is the official organ of the Department of Agriculture, Santo Domingo, has an article strongly advising the cultivation of castor oil plants in that republic. The writer of the article recommends the Indian or Bombay variety of the plant as being the best suited to local conditions, and gives instructions for its sowing and culture. He estimates that, with the present prices, the net profit per hectare from an average yield would amount to about $200, equivalent to about $40 per acre.

It must also be remembered that under the auspices of the Imperial Department of Agriculture experiments with this crop were made some years ago in Antigua. At that time it did not seem to hold out any prospects of being sufficiently remunerative to cause the cultivation to be taken up to any extent. The price then was not more than £12 per ton. The present market price is about £32 per ton, and seems likely to rise. The question therefore may deserve reconsideration in some of these smaller islands where the plant certainly flourishes. Could the seeds be dealt with locally for the extraction of the oil, the residue might be utilized as a fertilizer of considerable value. It cannot however be used as a cattle food. It might be possible for the present factories extracting cotton-seed oil to utilize their machinery for the production of castor-seed oil during the part of the year when their machinery perforce lies idle.

GLEANINGS.

The area under rice in British Guiana in 1917 was 6,000 acres with a yield of 45,000 tons valued at £500,000. The average yields of the colony per acre were only exceeded by those in Egypt and Japan, the abandoned sugar lands being especially suited for rice cultivation. (The *Demerara Daily Argosy*, April 27, 1918.)

From the *Cuba Review*, March 1918, we gather that although the sugar planters of Cuba have done exceedingly well with their crop, the tobacco planters are experiencing rather hard times on account of war conditions, the exportation of cigars from Havana for instance during 1917 being some 10,000,000 less than the previous year.

United Empire, April 1918, states that according to a report issued by the Colonial Office it is estimated that the natives in the British sphere of occupation in Togoland have 33 per cent. more land under cultivation now than they ever had under German rule. The freedom from forced labour gives them time to develop their own interests and resources.

The Parliament of South Australia has decided that all towns in the State bearing names of German origin are to be renamed. A first list of twenty-two such towns with the new names has been published, among which may be noticed the following changes: Kaiserstuhl to Mount Kitchener, Rosenthal to Rosedale, Grunthal to Verdun, and so forth. (The *Coloniser*, April 1918.)

Pig keepers who have access to grazing should give the fullest trial to outdoor methods of feeding. Green food alone will not as a rule fatten pigs, but it will keep them in healthy condition, and save a great deal of meal. Barren sows have actually fattened on good pasture without any supplementary foods, and palatable pork can be produced under the same conditions. (*Journal of the Board of Agriculture*, December 1917.)

In order to make clean liquid manure for application to vegetables, a bag of well-rotted stable manure is placed in a barrel filled with water. The bag should be well shaken in the water, and after about twelve hours the liquid may be used freely on the plants. The barrel may be filled with water several times before it becomes necessary to empty and refill the bag (The *Journal of the Jamaica Agricultural Society*, March 1918.)

Since the commencement of the war up to the present time it is stated in *Nature*, March 28, 1918, that tens of thousands of acres of woods and forests have been destroyed in the British Isles. What the effect of this will be upon the wild bird life it is difficult to foretell, but it seems very likely that it will mean a large decrease in the number of insectivorous birds, and that consequently for some years to come there will be trouble with plagues of various insects.

The name 'Jerusalem artichoke' is most inappropriate to that tuber. It is not an artichoke, and it is not a native of Jerusalem. De Candolle, in *Origin of Cultivated Plants*, says: 'the English name Jerusalem artichoke is a corruption of the Italian girasole, sunflower, combined with an allusion to the artichoke flavour of the root'. If we are to have a name that fits the plant it might be suggested that 'sun-flower potato' would meet the case. (The *Field*, April 16, 1918.)

The *Journal of the Jamaica Agricultural Society* for March 1918 draws attention to the fact that cane planters could grow large crops of corn through their young canes, and though corn takes something out of the soil which ought to go to the cane, still in these times there will be a margin in favour of the corn. This is an old-time practice which should be commenced again. It is stated that on the highly cultivated soils of sugar estates 30 bushels of corn should be the return per acre.

According to the *Port-of-Spain Gazette*, April 28, 1918, there has been an outbreak of swine fever or hog cholera in certain districts of the island, including Belmont and Diego Martin. The Government Veterinary Surgeon is busy in combating the disease. It is thought that the local outbreak is due to infection from Barbados, where the disease has been recently making ravages. It is to be hoped that the Trinidad authorities will be able soon to control and eradicate this disease by the only method known viz., serum inoculation.

Arrangements have been completed by the Ministry of Munitions for the fixation of atmospheric nitrogen on a large scale in the United Kingdom, as a source of supply for the production of explosives. It is probable that in order to save tonnage, and owing to the length of the voyage from Chile, it will be found necessary to develop this production still further. This source of supply is also expected to be of great value after the war for the production of fertilizers. (*The Times*, February 15, 1918.)

A party of American scientists, chiefly from the State University of Iowa, under the guidance of Professor C. C. Nutting, Professor of Zoology of that University, has arrived in Barbados for the purpose of studying the marine biology of these waters. The Government of the island has placed at their disposal the quarantine station of Pelican Island during their visit. They hope, after concluding their work in Barbados, to pay a visit to Antigua.

The term upland rice is applied to those varieties of rice which grow in ordinary well drained fields during the rainy season. An article in the *Philippine Agriculturist and Forester*, January-February, 1918, recommends upland rice as suitable for extensive rice culture wherever corn and sugar-cane are grown, or on newly opened lands in sugar-cane districts. The article states thst the putting of upland rice in rotation with sugar is recommended by the Bureau of Agriculture, and further, that there are varieties of upland rice which yield much more that any lowland varieties.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. According to notes forwarded by the Curator, during the month of April 885 plants were distributed, and 392 packets of vegetable seeds, 3 barrels of pigeon peas, and 60 barrels of horse beans were sold. Rainfall for the month was 1·86 inches.

MONTSERRAT. Mr. W. Robson, Curator, writes to say that plant distribution during the month of April comprised the following: Bay plants, 1,380; potato cuttings, 700; pigeon peas, 5½ lb.; black eye peas, 16 packets; corn cobs, 26; papaw seeds, 3½ oz. Work in the Experiment and Botanic Station was of a routine nature, consisting chiefly of reaping operations. Owing to the breakdown of the still at the beginning of the month, the distillation of bay leaves has been suspended.

The cotton planted at the beginning of March is suffering from lack of rain, particularly on the leeward side of the island. Very little cotton has been planted since the middle of March, and about half the area remains to be put in. Estates have increased their acreage so far as labour permitted. Over 400 bales of cotton of last season's crop remain to be shipped. The planting of areas in limes is practically at a standstill, and the area in plant canes will probably be below that of last season. All estates complain of shortage of labour, which is stated to be chiefly due to labourers planting cotton in their own interests. Foodstuffs still remain very scarce. At a general meeting of the Agricultural Society it was unanimously agreed to recommend that the Government proceed with the Cotton Stainer Ordinance for the destruction of the host plants of this pest. The appointment of an Assistant Curator has been arranged for as from July 1. Only light showers fell during the month. The rainfall recorded at Grove Station was 2·25 inches. The total rainfall for the year to date is 15·19 inches.

ANTIGUA. Plant distribution during the month of April was as follows: Pandanus, 1,301; lime plants, 500; coco-nuts, 341; eucalyptus, 165; onion plants, 100; decorative 61; cotton seed, 420½lb; miscellaneous seeds, 2 packets. Mr. T. Jackson, the Curator, states that the scarcity of water at the Botanic Station is seriously handicapping the work in the nurseries. Early in the month fairly good showers were experienced in some parts of the island. Advantage was taken of this by many to plant provision and other crops; but at the time of writing rain was required throughout the island. On the whole, the onion crop is almost a complete failure; apparently only one-fourth of the returns obtained last year will be harvested this year. This is attributed to the severe drought experienced during the last three months, which was followed by severe attacks of thrips. The conditions of the young cane crop improved somewhat during the month. Preparations are being made to plant cotton. The returns per acre for last year are decidedly poor; the amount of cotton reaped to date by Antigua and Barbuda was approximately 49,000 lb. Three hundred and forty crates of onions were shipped by the Antigua Onion Grower's Association. The rainfall for the month was 3·64 inches; for the year to date, 8·26 inches.

ST. KITTS. In his notes for the month of April the Agricultural Superintendent, Mr. F. R. Shepherd, mentions plant distribution from the Experiment Stations as follows: 7,700 cassava cuttings and 1,200 sweet potato cuttings; 200 cuttings of ornamental plants were also distributed from the Botanic Station. Owing to the dry weather, which made constant watering necessary to keep the plants alive, only the usual routine work could be carried out. The cane crop was being rapidly taken off; the returns, with a few exceptions, were very low. The young canes were feeling the effects of the dry weather, and plants recently supplied, especially in the Valley district, were germinating poorly.

A considerable area of cotton has been planted in the northern district where weather conditions are more favourable, and the young plants are doing well. In the Valley district very little has as yet been planted, but with the advent of rains a large acreage will be put in. Wherever possible, sweet potatoes, cassava, and corn have been planted. At the end of April 586,804lb. of lint cotton was awaiting shipment at St. Kitts-Nevis. The rainfall for the month was 1·07 inches, for the year to date, 9·81 inches.

AGRICULTURE IN BARBADOS.

Although the rainfall has been in some districts below the average, the weather during the past month was more favourable than during April 1917. It will be remembered that the last two weeks of April 1917, were the driest and dustiest for the whole year.

The total rainfall for the four months of this year in the hilly parishes is about 13 inches, while in the low lying parishes it is just under 7½ inches.

On some black soil estates the crops have been completed. The season has been practically perfect for grinding, but the yield has been under last year's mark

We have noted that this year's crop will be shorter than last year's or that reaped in 1916. We are aware that weather conditions have had a good deal to do with this, but we cannot refrain from sounding a warning note, as on more than one previous occasion, in connexion with the treatment of the soil. We are of opinion that our soil, in spite of the tillage and manuring which it receives, needs further help. There should be rotation of crops, and a period of rest for every field, if we would keep up a high standard of fertility.

Once more, the rotation of crops would afford excellent opportunity for green manuring. Hardly any of this is done at the present time, but it is acknowledged by scientific agriculturists that this is a most effective means of feeding the soil with those constituents which it requires. It is also an inexpensive process. Many a light sandy soil which needs humus would be restored to a healthy condition by the ploughing in of green crops.

Where recent showers have fallen in sufficient quantity, the young crops have immediately responded. It is marvellous to see how quickly the blades of grass shoot up from the earth after a rain. The young canes in the hilly districts are, we think, in a more satisfactory condition than they were at the corresponding period last year.

The ratoons are bunching well, and a few fortunate planters have been able to put in the first application of artificial manure to some fields. A limited supply of nitrate of soda is daily expected, and arrangements are being made to obtain the sulphate of ammonia required for the coming season.

The supply of ground provisions has naturally grown scarce. There are very few fields of mature potatoes left, and many planters are anxious not to continue selling until they have been able to plant. They have to be very careful lest they run out of slips.

With the recent rains some planting of corn and potatoes has been done, but only to a limited extent, for on many estates it has not been possible to prepare the land. (The *Barbados Agricultural Reporter*, May 4, 1918.)

PLANT DISEASES.

SUGAR-CANE DISEASES IN THE WEST INDIES.

The current number of the *West Indian Bulletin* contains a detailed review by Mr. J. R. Johnston, Pathologist of the Central Experiment Station, Cuba, of the diseases of sugar-cane in the West Indies. Information concerning the history, causation and symptoms of each disease, the original accounts of which in many cases are widely scattered in literature difficult of access, is brought together in a form convenient for reference.

In order that the paper might supply as far as possible a complete survey of the distribution and status of sugar-cane disease in this region, the manuscript was submitted to, and, excepting Trinidad, has been annotated by the responsible pathologists of the cane-growing areas from Cuba to British Guiana. The notes appended give evidence of no important divergence of opinion, and subject to possible differences of emphasis, the paper may be taken adequately to represent the present situation. It is to be hoped that it may have an influence in checking the persistent text-book currency of the series of early errors associated with the description of *Trichosphaeria Sacchari*, Massee.

Apart from the great epidemic of the nineties on the Bourbon cane, the interest of which, owing to the general adoption of resistant varieties, is now mainly historical; and the new epidemic in Porto Rico, which is too recent to have revealed its true significance, the outstanding interest of the present day is with the root disease associated with *Marasmius Sacchari*. The remaining affections, where they are not trivial, are local and incidental; root disease is general in its distribution, and, under frequently recurrent conditions, serious in its effects.

The presence on the base of canes and on the trash of white mycelia other than that of Marasmius has been commonly noticed, and there is no doubt that they have often been confused. Three of these fungi are here described as the outcome of attention given to root disease in Porto Rico. *Himantia stellifera*, Johnston, is regarded as identical with what has been previously known as the 'stellate crystal fungus'; its mycelium is distinguished on a general view by the feathery pattern it assumes in its growth. and, on microscopical examination, by the stellate crystals of calcium oxalate borne on short side branches. It is common on cane and pasture grasses. *Odontia saccharicola* and *O. Sacchari*, Burt, are Basidiomycetes of very simple form. The first-named, 'the granular leaf-sheath fungus', is very common in Porto Rico at the base of cane stalks, binding together the lower leaf-sheaths. The only visible damage resulting is the rotting of the sheaths infested. It occurs on healthy and unhealthy cane, and its chief importance arises from the readiness with which its occurrence may give rise to the assumption that Marasmius is present. *O. Sacchari* is a similar but rarer species.

It would be well worth while to investigate more closely the occurrence of these fungi in other localities. The same or similar species are common in some of the Lesser Antilles, with at least one other form in which the hyphae are combined into strands of various thickness, and heavily encrusted with needle-crystals of calcium oxalate.

The control of root disease is discussed at some length, the recommendations being on familiar lines. Some interesting information emerges as to the views taken of varietal resistance to the disease.

With regard to *Melanconium Sacchari*, the rind fungus, the subject of so much dispute, the conclusion reached, to which no objection is entered, is that the damage due to it typically occurs only in over-ripe or injured cane, though occasionally it is the only fungus to be found in mature canes affected with a rot marked by sourness and a dingy appearance of the tissues. The severity of infestation with this fungus, even when conditions appear favourable to its development, as in severe moth-borer seasons, is observed to vary greatly for reasons not yet explained.

Colletotrichum falcatum is now litt'e noticed, but it may be again recorded here, from recent instances, that it is very liable to occur with unreduced virulence, reproducing the symptoms of the old 'rind disease', when plots of Bourbon cane are tentatively tried.

W.N.

THE FOOD SITUATION IN BERMUDA.

It appears that, although Bermuda is so much nearer to the United States than these West Indian colonies, it has been placed under the same regulations with respect to the exportation of foodstuffs. Mr. E. A. McCallan, the Acting Director of Agriculture, Bermuda, has forwarded to this Office an interesting report on the steps that are being taken in that colony to increase the local production of foodstuffs, and to lessen the colony's dependence on imported foods. The matter is, in the first place, under the direction of a committee of the Board of Agriculture, and in every parish local committees have been appointed to stimulate production in their respective districts.

These local committees are evidently, as the report shows, doing excellent work in a very thorough manner. Besides the holding of general meetings, and the issuing of pertinent bulletins, the members of the local committees undertake individual house-to-house visits in which the necessity of increased vegetable and live-stock production is explained, and instructions are given in household economy, and in the best methods of cultivating kitchen gardens. In connexion with this matter, members of these committees undertake in many cases not only to distribute packets of vegetable seeds, but also the growing of vegetable seedlings for distribution among kitchen gardeners. In many cases lectures are given to housewives on subjects of household economy, cookery classes are held, useful 'war' recipes are published and distributed, and demonstrations in methods of preserving food, as for instance by canning, are also given. The schools are visited and prizes have been offered for work in school gardens.

The results of this diligent work seem to have been most satisfactory. The local committees, in general, report that there has been a very considerable increase in the extent of land under cultivation of foodstuffs, especially of staple crops; that there has been an extension of school gardens, and that much grass land and many flower gardens have been put under food crops. There has also been an increase in the number of small live stock produced, especially pigs, goats, and rabbits, so that the locally produced food for home consumption has been much augmented. Another result has been the inception of a vigorous campaign for the extermination of rats, on account of the loss caused by their depredation on stored food. Efforts are also being made to keep the sparrow in check because of the damage to growing crops.

It must be very satisfactory to the members of the various committees to find that their visits and advice have met with cordial appreciation by the people in general, who have been thereby stimulated in the increased production of food.

MANUFACTURE OF PAPER FROM MEGASS.

In the *Agricultural News*, December 15, 1916, attention was drawn to a new process for destroying weeds in cane fields by the use of paper mulches, and it was noted that the erection of an auxiliary paper mill was being contemplated by the Directors of the Olaa Sugar Company for the purpose of making the paper needed. The *Louisiana Planter*, for April 6, 1918, says that the manager of the Olaa plantation, in his annual report to the stockholders, states that:—

'Following a careful investigation into the practicability of making a suitable mulching paper from bagasse as the raw material, it was decided in December last that a small auxiliary paper plant be erected alongside of the sugar factory to turn out approximately 16 tons of asphalt-saturated paper per day.

'It has been demonstrated that about 50 per cent. of the labour ordinarily required in the care taking of our cane fields can be saved by the employment of suitable paper mulches in accordance with the practice which has been developed under Olaa conditions, and that a materially increased yield can be obtained at the same time.

'The product of the auxiliary mill will, therefore, be used primarily to meet the agricultural needs of the plantation, and only a comparatively small surplus output will be placed on the general market where it should find a ready sale in the forms in which its manufacture will be adapted for the trade. In addition to the manufacture of mulching paper for which the plant is primarily intended, it will be equipped and devised so as to permit the production of roofing and sheathing felts, tissue and wrapping paper, and card and box boards. About one-tenth only of the present supply of bagasse will be utilized in paper manufacture, the balance of it being used as formerly, as fuel in the furnaces.'

It is hoped to have this auxiliary plant in operation by the beginning of 1919. The estimated cost of the plant is $185,000.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of March 1918:—

The conditions of business in Mincing Lane during the month of March exhibited but little or no change since our report of February. The continued reduction of imports of natural products, owing to the still prevailing submarine menace, has had the effect of more enquiries being made for synthetic products, which might result in lowering the prices of the better-known products of nature. Purchasers continue to show a desire to buy only those articles that are absolutely necessary to meet their present requirements, and these only in limited quantities. The following are the chief details.

GINGER.

At auction on the 14th. of the month ginger was in good demand at advanced rates. Washed, rough Cochin was held at from 72*s*. 6*d*. to 75*s*. for fair to good; 70*s*. was asked for rough Calicut, and the same price for Sierra Leone. A week later ginger was again in good supply, some 879 packages being offered and sold, rough washed Cochin fetching 90*s*. per cwt., fair to good brown Calicut 80*s*. to 85*s*. 6*d*, and limed Japan 75*s*. It was stated at this auction that some sales of Jamaica had been effected at 97*s*. 6*d*. to 100*s*. for common to good lemon, and 110*s*. to 115*s*. for medium to good. Similar prices prevailed quite to the end of the month.

SARSAPARILLA.

There has been but little or no business done in this drug throughout the month. The only offerings made were on the 14th., when 19 bales of grey Jamaica were offered, and sold at from 4*s*. to 4*s*. 1*d*. for fair quality.

MACE, NUTMEGS, PIMENTO, ARROWROOT, KOLA, CANELLA ALBA, ANNATTO SEED, LIME OIL, CITRIC ACID.

At auction on the 21st. of the month mace was represented by 78 packages, which were disposed of at from 1*d*. to 2*d*. per ℔. advance of previous rates. Nutmegs were also well represented by 237 packages of West Indian, which were also disposed of at similar rates. In the middle of the month it was reported that a good amount of business had been done in Pimento at from $4\frac{1}{4}d$. to $5\frac{1}{4}d$. per ℔., which had slightly increased towards the end of the month.

At the beginning of the month good manufacturing St. Vincent arrowroot was quoted at $10\frac{1}{2}d$. to 11*d*. per ℔., but later 1*s*. to 1*s*. $1\frac{1}{2}d$. was asked and at the end of the month 1*s*. $1\frac{1}{2}d$. was the price quoted. It was reported in the middle of the month that kola was becoming scarce. At auction on the 14th. 17 bags were offered, and the whole disposed of at an advance on previous rates of about 3 farthings per ℔. The consignment brought forward consisted of West Indian halves, varying from small to medium, and slightly mouldy: $10\frac{1}{4}d$. per ℔. was the price paid. Cannella alba bark was represented at auction on the 14th. of the month by 10 packages, none of which was disposed of. Annatto seed was also in abundant supply on the 14th. of the month, with 90 packages. These also failed to find buyers. West Indian distilled oil of lime was sold in the middle of the month at 7*s*. 6*d*. to 7*s*. 9*d*. per ℔. and hand pressed at 21*s*. Citric acid has been quoted during the month at from 3*s*. $1\frac{1}{2}d$. to 3*s*. 2*d*. per ℔.

British Production of Black Pepper.—Although the Dutch East Indies are by far the most important pepper-producing locality of the world, *The Times Trade Supplement*, April 1918, points out that the Malabar coast of Southern India produces a considerable portion of the article imported into the United Kingdom. In Sarawak pepper is the chief crop of the country, and it is also an important article of production in the Malay Peninsula. Pepper was formerly grown in Zanzibar, but its cultivation there has been abandoned. The cultivation of pepper has not been carried on in the West Indies or South America; it has been successfully tried in Trinidad, but never planted on a large scale. In Jamaica also it has been tried but did not flourish.

MARKET REPORTS.

London.—The West India Committee Circular, March 21.

Arrowroot—No quotations.
Balata—Venezuelan Block, 3/4; Sheet, 3/11 to 4/1.
Beeswax—No quotations.
Cacao—Trinidad, 95 -; Grenada, no quotations; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 3/3.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—2/9 to 3/9.
Nutmegs—1/7 to 2 4.
Pimento—5¾*d*.
Rubber—Para, fine hard, 2 8½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., March 27.

Cacao—Venezuelan, $13·25 to $13·75 Trinidad, $13·50 to $14·00.
Coco-nut Oil—$1·36 per gallon.
Coffee—Venezuelan, 11c. to 12c. per ℔.
Copra—$8·00 per 100 ℔.
Dhal—$14·00.
Onions—$8·00 per 100 ℔.
Peas, Split— $11·50 to $12·00 per bag.
Potatoes—English, $6·00 per 100 ℔.
Rice—Yellow, $12·00 to $12·25; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros. & Co., April 3.

Cacao—Caracas, 13½c. to 14c.; Grenada, 14c. to 14½c.; Trinidad, 14¼c.; to 14¾c. Jamaica, 13¼c.
Coco-nuts—Jamaica selects, $58·00 to $60·00; Trinidad selects, $55·00 to $56·00; culls, $22·00 to $30·00 per M.
Coffee—Jamaica, 10c. to 12c. per ℔.
Ginger—15½c. to 20c. per ℔.
Goat Skins—Jamaica, 75c.; Antigua and Barbados, 75c.; St. Thomas and St. Kitts, 75c. per ℔
Grape Fruit—Jamaica, $2·75 to $3·00 per box.
Limes—$13·00 to $13·50 per brl.
Mace—36c. to 40c. per ℔.
Nutmegs—23c.
Oranges—$5·00. to $7·00
Pimento—6¾c. to 7½c. per ℔.
Sugar—Centrifugals, 96°, 6·005c; Muscovados, 89°, 5·005c. Molasses, 89°, 4·948c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., April 16.

Arrowroot—$12·00 per 100 ℔.
Cacao—$12·50 per 100 ℔.
Coco-nuts—$36·00 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $4·75.

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A FORTNIGHTLY REVIEW

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Organization of West Indian Agriculture.

THE organization of the agricultural interests of the West Indies is a subject of great importance to all those interested in the future welfare of these islands. For in the past our greatest weakness has been a kind of parochialism, each island—and in the case of the larger islands, each district—thinking only of its own limited interests. This has been the case with all the chief industries, and has led to weakness in them all.

There is an old Latin saying, *Fas est ab hoste doceri*: it is right to be taught by the enemy—and if there is one lesson which we can rightly learn from the Germans it is the value of organization. Germany had so correlated all her activities that she was able to throw all her energy in any direction. This was shown in every branch of industry and commerce before the war began, and during the war it has been proved in military matters. To her organization, not perhaps so very wonderful or very efficient, but appearing so by contrast, Germany owes her military efficiency, and her powers of endurance.

But to return to the question of West Indian agriculture, let us take some of the chief industries, and examine some aspects of the problem of organization in connexion with them. By this problem we mean in the first place, the correlation of supply and demand, and in the second place, the correlation of capital and labour.

The vicissitudes of our oldest, most wide-spread industry, the cultivation of sugar-cane and the manufacture of sugar, afford an instance in most of these islands of the evils which result from want of organization in both those directions. When the highly organized beet sugar industry began to threaten the supremacy of cane in the markets of the Mother Country and of the world, it was long before those interested in the sugar-cane began to 'learn from the enemy'. The beet-growing countries organized a system whereby the grower could devote his energies to the production of the highest amount of beet of the highest saccharine content, while the manufacturer and refiner devoted his to the turning out of the purest sugar possible, at the lowest cost. Meanwhile

the sugar-cane grower was content for long to continue to combine the functions of grower and manufacturer in one; to make no attempt to grow more or richer canes, and to make sugar of most inferior quality. It is not to be wondered at that the pure white crystallized beet sugar was preferred by the consumer to the dark muscovado laden with impurities. This condition has been changed in recent times. The organization of the sugar industry—though by no means perfect—has in most of these islands led to the establishment of central factories, which supply the sugar market with a standard product of approved excellence, while the planter directs his attention—with marked good results—to the production of more sugar per acre by improved methods of cultivation, and the employment of better varieties of cane.

For the future stability of the cane-sugar industry in these islands it would seem that better organization must be arranged in the second direction. The labour supply of almost all these islands is very limited. The cultivation of sugar-cane and its manufacture have not hitherto seemed able to afford sufficient attraction to the working classes to retain them permanently; they emigrate, as is well known, in large numbers of the most industrious type. How to remedy this is a problem to be faced. The present high prices of food have called for, and the high price of sugar has permitted, a substantial rise in the labourers' wages on sugar plantations. That, however, is not enough, for the high price of the product will not continue indefinitely, and wages cannot be reduced without dissatisfaction. There must be organization between the employer and labourer to attain more production per man, thus enabling each man to obtain rightfully more pay. Just as the employer must remember that he ought to give 'a fair day's wage,' so the labourer must recognize that he must give 'a fair day's work.' One wonders whether after all some system of organized profit sharing is not the panacea which Maurice and Kingsley believed it to be.

The more advanced experience of industrial countries shows that little is to be hoped from merely moral suasion on either side. There must be either the compulsion of necessity or a community of interest.

The former is the basis of the present system, and it may be possible to continue it, in the face of a reduction of the working population, by the better organization of work and more extended use of agricultural machinery. The development of mechanical power has been the means by which prosperity has been achieved in every modern manufacturing industry. It does not in itself remove the labour difficulty, but it postpones it, and by the economies it permits, affords a margin which is wisely used if it is applied to make the conditions of the worker more attractive. The attention of economists is at present hopefully turned towards the efforts of enlightened employers in this direction, in which a degree of success has been achieved which, to many at least, was unexpected. It is admittedly difficult, in an industry which not so very long ago was based on slavery, to adopt this point of view, but there is no other of which we are aware that offers the same prospects of either sound commercial prosperity or social amelioration.

The cane-sugar industry in those islands is, with the exception of the lime industry, the only one in which the manufacturing of the marketable article is carried out locally. The other agricultural industries are concerned with the growth and exportation of raw products. In such the correlation of the grower and manufacturer seems to be the desirable aim of organization.

In a recent editorial of this Journal the advantages which the cacao planters would derive from organized attention to the requirements of the cocoa manufacturers were pointed out, and therefore need not be repeated.

Such advantages have already accrued in the case of the cotton industry in several of these islands from organization in the direction of finding out what the spinners chiefly require in cotton, and then combining to supply them with a dependable supply of the desired material.

A narrow but to some extent current view of the function of agricultural departments in these islands has been that they exist to give advice to the cultivator regarding his cultivation. This they will no doubt continue to do where it seems to be required. But a more important duty is the adjustment of the quality of the raw material produced in the tropics to the requirements of the industries dependent on them. This may be achieved, to mention some of the means, by the improvement of crop plants, by seed supply, by education in the requirements of the market, and by the promotion of co-operation among growers.

THE DEVELOPMENT OF THE CUBAN SUGAR INDUSTRY.

When the industrial history of the West Indies comes to be written, it will not fail to be noted that the cultivation of the sugar-cane has been one of the chief factors in the fluctuations of prosperity which they have experienced.

A brief sketch of the history of the sugar industry in Cuba, by H. O. Neville, published in the *Cuba Review*, March 1918, gives a very interesting account of the influence which this industry has had on Cuban affairs.

The exact date of the introduction of the sugar-cane into the island of Cuba appears to be unknown, but it would seem that not very many years after the discovery of the New World by Columbus, the plant was introduced from the Canary Islands by Diego Velasquez, the conqueror and first Governor. It is stated that he bent his energies to the utilization of the agricultural resources of the island, especially favouring the cultivation of the sugar-cane. For this purpose he made grants of land to his followers, and assigned to them numbers of the wretched aborigines as slaves needed in the work.

After his time, during the sixteenth and seventeenth centuries, Cuban industries, especially the manufacture of cane sugar, were much oppressed by the Spanish Government; at one time the planting or cultivation of sugar-cane was even prohibited. Even after this prohibition was withdrawn, monopolies and restrictions were so continued that the industry could not advance, in spite of the natural great advantages possessed by the island. In 1772, however, most of the restrictions were removed, and active progress in the industry began. The exportations of sugar rose from 4,392 in 1760 to over 14,000 tons in 1790. The insurrection in Santo Domingo, and the ruin and destruction of the prosperous sugar industry there in 1791 gave Cuba an opportunity of filling the place formerly held by that island. In 1792 the exports of sugar were 14,600 tons, which rose to 40,800 tons in 1802. It must be remembered that this production was only from small mills worked by oxen—the only kind of mill which at that time existed in the island.

Owing to the Napoleonic wars during the early years of the nineteenth century, the Cuban sugar industry was severely depressed by war conditions. But after the establishment of peace, prosperity returned, so that by 1826 production had fully reached its former figure. The increase in the area of land tilled caused the same difficulty to be felt as has been likewise felt in these last years, namely the lack of sufficient labourers to handle the crop. In 1834, the very year that emancipation was proclaimed in the British West Indies, the then Governor of Cuba encouraged the slave trade by every means in his power, and was instrumental in the introduction of numbers of slaves from Africa. At the same time, it must be said, he discouraged many of the corrupt and restrictive customs which had been practised by former Spanish Governors. Then began the period of greatest prosperity ever enjoyed by Cuba before its occupation by the United States. No accurate record is obtainable of the area planted under cane, or the total production during the greater portion of the period, but approximate data indicate that in 1870 some 610,000 tons of sugar were produced from about 1,200 small mills.

For the next ten years the continuous war of rebellion changed these conditions. The island was swept with fire, frequently set by the mill owners themselves, the fields burned, and most of the mills destroyed. Meanwhile also the beet sugar industry in Europe was forging ahead under the protection of bounties granted on sugars produced for export. In 1880 all slaves in Cuba were set free without any remuneration being given to their owners. The labour difficulty was thus again confronting the planter. Nevertheless the output of sugar began to increase year by year, until in 1890 it again reached some 625,000 tons, practically the position which it had occupied in 1870, though it is evident that, as this output had been produced by about 470 small mills, there had been great improvement in the capacity of each mill.

In the early days of the small mills each cane grower had his own little cattle-mill, ground his own cane, and made his own sugar. As labour became scarcer after the liberation of the slaves, many of the small owners were no longer able to obtain the labourers that they required, and many of the larger planters found it necessary to sublet their lands in small parcels. This gave rise to the system at present prevalent in Cuba, by which the cane growers have no connexion with the manufacture of the sugar, merely growing and selling their canes to the mills. The separation of grower and manufacturer continued to spread, and concentration of small mills and estates was effected more and more till to-day in Cuba is to be seen the giant central factory, purchasing cane often grown as much as 100 miles from the mill, possibly from growers who have never visited the factory that grinds their cane. This period of reconstruction continued with ever-increasing output till the year 1894, when a production of 1,054,214 tons was obtained. The War of Independence, the bloodiest in the history of Cuba, broke out in 1895, and incendiarism was so freely practised that by 1897, the greater part of the factories had been destroyed, the fields burned, and the cattle used for transporting the canes killed, so that the production of the island had fallen to only 212,051 tons. The losses of this war added to the reasons for the concentration of estates, as many planters emerged from the struggle without funds or credit with which to re-establish themselves on their former lines. Thus the sugar-manufacturing business began to fall into the hands of large companies, and this tendency continues and has doubtless become firmly established.

The increase in the average capacity of the mills is shown by the fact that in 1907 the average production was about 8,000 tons per mill, while in 1917 it was about 16,000 tons.

A very important factor in the recent great development of the sugar industry in Cuba is the effect that the present war has had upon the production of sugar all over the world. At the time the war broke out sugar prices in Cuba had reached about their lowest level, and there seemed to be little hope of a future rise. The good prices realized for sugar since the beginning of the war seem to have put the industry on a firm basis. Capital has been obtainable, enabling mill owners to scrap all old and inefficient plant, and to instal the most modern machinery, so that they are now in a position to face lower prices with confidence that the results obtained in the factory will enable them to produce sugar at lower cost than ever before, when the price of supplies, labour, etc., once more become normal.

An account of the development of the sugar industry in Cuba would hardly be complete without figures giving the relation between the total world production of sugar, the total world production of cane sugar, and the cane-sugar production of Cuba alone. Fifty years ago the total production of sugar in the world was estimated at nearly 2,000,000 tons, while the production of cane sugar at the same date was about 1,447,000 tons, of which Cuba produced 620,000 tons. For the year 1916-17 the world's production of all kinds of sugar was estimated at 16,466,777 tons. the total amount of cane sugar produced being put at 11,263,292 tons, of which Cuba contributed 3,019,936 tons, or a little more than 18 per cent. of the total production of sugar of the world, and nearly 27 per cent. of cane sugar.

PROMINENT BREEDS OF DAIRY CATTLE.

Farmers' Bulletin 893, United States Department of Agriculture, contains interesting information, together with a brief history of the origin and development of the chief breeds of dairy cattle which have attained considerable prominence for the purpose of dairy products in the United States of America. The prevailing type of each breed, and the ideal towards which the breeders are striving are described in this bulletin. Inasmuch as some of the breeds included in the discussion—four at least—have now for some time been introduced into the British West Indies, it should be of interest to dairymen in these colonies to reproduce here certain of the characteristics noted in connexion with these breeds of cattle.

In the United States five breeds of dairy cattle have attained considerable prominence, namely, the Ayrshire, Brown Swiss, Guernsey, Friesian, and Jersey. These breeds have been developed carefully for a considerable time for the purpose of dairy products, and in consequence, each transmits its characteristics with regularity to its offspring. Certain distinct features distinguish each breed from the others, but all possess ability as milk producers. There is, of course, considerable variation in the characteristics of individuals within each breed; but the description given in the bulletin refers to the general, or predominating, type.

AYRSHIRE.

The Ayrshire breed originated in the County of Ayr, in south-western Scotland. It is only within the last hundred years that Ayrshires have had a type well enough established to be entitled to the designation of breed. No exact account of the different infusions of blood of other breeds into the native Scotch cattle to form the Ayrshire breed is at hand. It is probable, however, that the Channel Islands, Dutch, and English cattle were all represented.

The colours of Ayrshires may vary from a medium red to a very dark mahogany-brown and white, with either colour predominating. Of late years among breeders there has been a decided tendency toward white with red markings. Perhaps the most picturesque feature of animals of the breed is their long horns, which turn outward, then forward and upward. Another point, of which breeders of the Ayrshire are very proud is the uniform, square, level udder with long body attachment, which is common among the cows. Quick, brisk actions are characteristic of the animals, which seem always to have an abundant store of energy, and to be exceptionally alert. Ayrshires have a highly nervous disposition, which is useful both for production and self-support. Probably none of the other dairy breeds can compare with the Ayrshires in ability to obtain a livelihood on scant pastures. Their ability as 'rustlers' has made them very useful in sections where there is much rough land in pasture. The animals are noticeably compact in body, with a tendency to smoothness over all parts. As a breed Ayrshires are generally very hardy, and show great constitutional vigour.

Milk from Ayrshire cows contains comparatively little colour, and has the fat in uniformly small globules which average smaller in size than in any other breed.

GUERNSEY.

The Guernsey breed had its early development on the Channel Islands of Guernsey and Alderney. The origin of the breed is obscure, but it is probable that the parent stock came from Normandy, which is adjacent to the islands. Early live-stock laws of the islands prevented the importation of live stock for any purpose except slaughter, and under these conditions, in the course of the last century, the cattle developed into a distinct breed. Although they come from the same parent stock, Guernseys differ from Jerseys in having been developed by men who had somewhat different ideals. The Guernsey of to-day is larger than the Jersey, and differs in other respects, as is pointed out later.

The characteristic colours of Guernseys are some shade of fawn and white. The former varies from a very light orange fawn to a deep reddish or brownish fawn. An orange fawn with white markings, the fawn predominating, is perhaps the most common. The under parts of the body, legs, and switch of tail are usually white. A buff nose, and amber-coloured horns of medium size are typical of the breed.

A rich yellow secretion of the skin is most highly thought of by breeders, and is considered as an indication of the quality of the milk. Guernseys possess a nervous disposition, but are very quiet and gentle if properly handled, and are not easily excited. They are medium in size. There is some resemblance between the Guernsey and the Jersey, but the former is larger and slightly coarser-boned, with a deeper and more 'rangy' body. The head also is somewhat longer and more narrow than that of the Jersey.

Milk from Guernsey cows is noted for its extremely yellow colour, and high percentage of butterfat. The fat globules are larger than those in milk from either Friesian or Ayrshire cows, and consequently the cream rises more rapidly upon setting. Guernseys are particularly adapted for the production of butterfat or cream, or for rich milk at a special price.

FRIESIAN.

In the low countries bordering on the North Sea, especially in the northern part of Holland, Friesian cattle have been bred for centuries. Different names have been used to designate the breed, both in Europe and America, among which the following are the more common: North Hollander, Holland, Netherland, Holstein-Friesian, Dutch, Dutch-Friesian, and Holstein. The last is the name usually employed in the United States of America, but Friesian is the official name in England. Friesians have grown greatly in numbers and popularity in recent years, owing in a great degree to the increased demands of large cities for market milk. With the exception of the Jersey, there are more Holstein cattle in the United States than of any other dairy breed.

A universal characteristic of the Friesian cattle is the black and white colour of their coats. The sharply defined and contrasting colours of jet black and pure white give them a very striking appearance. Although either colour may predominate, black below the knees is objectionable. Pure-bred animals with any red or grey on their coats are ineligible to registry. In disposition Holsteins are docile, even-tempered, and not excitable; in fact, they are rather lazy in general habits, as is shown in their poor 'rustling' ability in grazing scanty pastures. They are large consumers of feed, especially roughage, and do best when plenty is readily available. The Holstein is the largest of the dairy breeds. It has a large, bony frame, which often is smoothly covered over all parts. As a breed it shows good constitutional vigour. The breed has been criticized for irregular udders and sloping rumps, but these defects are being improved.

From the point of view of milk production, Holsteins average higher than any other breed. The percentage of butterfat, however, which averages lower than that of any other dairy breed, tends to counterbalance the advantage of a greater production. The butterfat of Holstein milk is in the form of very minute globules, and for that reason the cream does not rise so rapidly on the milk. Holstein milk

has little colour, and its percentage of butterfat, according to the average test of some strains of the breed, is only 3 per cent., or even lower.

JERSEY.

The island of Jersey, the largest of the Channel Islands, is the native home of the Jersey breed of cattle. Except for immediate slaughter, no cattle have been landed on the island since 1779, so that ever since that time the purity of the breed has been preserved. It seems probable that the foundation stock is the same as the Guernsey, namely, from Brittany and Normandy, in near-by north-western France. Conditions on Jersey are similar to those on Guernsey. The breeders on the island have developed cattle that, in addition to productive ability, have uniformity of type and natural beauty, while in America the breeders have developed greater size, with less refinement of features.

Jerseys vary considerably in colour. The solid-coloured animals are preferred by many breeders. Various shades of fawn, squirrel gray, mouse colour, and very dark brown are common colours, and in the broken-coloured animals, white is mixed with these colours. The muzzles and tongues are usually black or lead-coloured, and it is very common for animals to have a light or mealy ring around the muzzle. A black switch is also a desirable feature. Next to the Guernsey the Jersey has the yellowest skin secretion of all the dairy breeds. The horns are small, waxy, and frequently are tipped with black. Jerseys have a distinctly nervous disposition, and are usually somewhat excitable. Their highly organized nervous system causes them to respond quickly to good treatment and abundant feed. Some have criticized the breed for small size, lack of development of symmetrical udders, and small teats, and the breeders have made much improvement in remedying these features. Jerseys are the smallest of the dairy breeds. Compared with the Guernsey, the Jersey is smaller, and has finer features and more refinement throughout.

In natural yellow colour the milk of Jersey cows ranks next to that of Guernsey cows, and is usually slightly richer in butterfat. The large fat globules cause the cream to rise readily upon standing. Jerseys, like Guernseys, are therefore adapted to the production of butterfat.

Details as to the scale of points for each of the breeds discussed, and records of the highest milk and butterfat producers for a given period for each of the breeds, may be obtained on reference to the bulletin quoted above.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. Plant distribution during the month of April included 11,770 cane cuttings of selected varieties, and 30lb. of Para peas. Work in the Botanic Garden was of a routine nature. In regard to staple crops, Mr. Sands states there is little to record. Preparations for planting cotton were made. A large portion of the arrowroot crop was awaiting shipping opportunities. The Marie Galante cotton crop of the Grenadines was purchased by the Government Ginnery. Exports of refined cotton-seed oil were made by a local refining company. The corn and ground provision crops continue to make good progress, and there was no likelihood of a shortage of locally grown foodstuffs. The campaign against cotton stainers was continued energetically.

A number of planters from Grenada arrived at St. Vincent on April 4 for the purpose of obtaining information on cotton growing and ginning. The Agricultural Superintendent visited the cotton ginnery and granary with them. The granary was then working at its full capacity, and the methods of handling seed-cotton, cotton seed, and corn were fully explained. A visit was also paid to the Experiment Station, where the breeding experiments with cotton, corn, peas, and other crops were inspected. The rainfall recorded for the month was—Botanic Garden, 4·54 inches; Experiment Station. 3·21 inches.

NEVIS. The Agricultural Instructor, Mr. W. I. Howell, mentions the continuation of dry weather during the month of April, which is seriously militating against the crops in the experiment plots, and cultivations throughout the island generally. Plant distribution was as follows: cotton seed, 225lb.; black-eye peas, 14½lb., Para peas, 3lb.; seed corn, 2lb.; sweet potato cuttings, 1,800. The cane crop continues very poor, and the outlook, on the whole, is not very hopeful. Preparation for cotton was almost complete, and a fair amount of planting had been done, but on account of the dry weather germination has been poor and no field is yet established. The planting of provision crops has been carried on by many of the planters, but the crops are making very little progress for the reason stated above. The live stock in some parts of the island are in very bad condition, and many deaths have occurred from starvation. The rainfall for the month registered 2·59 inches; for the year to date, 10·79 inches.

VIRGIN ISLANDS. Mr. W. C. Fishlock, the Curator, states that no plants were distributed during the month of April, but 105lb. of cotton seed was sold. The gathering of the present cotton crop is now nearly over. The quantity of cotton dealt with by the Government Factory during the season appears to be the smallest since 1907. The sugar crop has been reaped, and ground provisions continue to be fairly plentiful. The weather continued dry. Rain fell in measurable quantity on ten days of the month, the total precipitation registered at the Station being 1·17 inches, as compared with 2·38 inches, the average for the previous seventeen years.

AGRICULTURE IN BARBADOS.

In the centre of the island the weather for the current month has been ideal. In marked contrast with this, very dry weather has prevailed along the sea-board in Christ Church and St Philip.

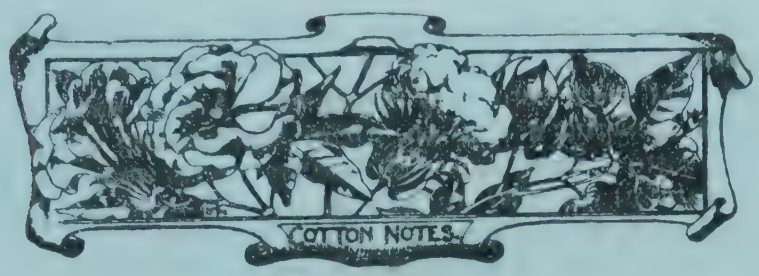
Generally speaking the earth is not dry and parched as at this date last year, nor are so many cracks apparent in the fields and pastures.

The young plant canes have, on the whole, stood the strain of the dry weather very well indeed.

Artificial manure is now needed in order that the ratoons may not be handicapped. Here and there a planter has been able to get a small quantity with which to make a start, but there has been as yet no arrival in bulk. A shipment of nitrate of soda was expected about the beginning of this month, but it seems that the engagement cannot now be filled before the middle of June. The crisis demands that there should be no grumbling, but thankfulness that we are able to get supplies at all.

This year will always be remembered as the high-water mark for syrup. It has paid the owner of every windmill, even with its imperfect crushing, to make syrup rather than to sell canes on a dark crystal basis.

Where the crops have been finished, tillage for provisions is being done, but slowly. There will be a great scarcity of potatoes during the coming months, and cereals should be freely planted as these mature rapidly. The utmost possible care should also be bestowed on the breadfruit and banana trees. The former, we are glad to say, are beginning to bear. (The *Barbados Agricultural Reporter*, May 18, 1918.)



COTTON.

COTTON EXPORTS FROM THE WEST INDIES.

The following figures give the quantity and estimated value of Sea Island cotton exported from the West Indies for the quarter ended March 31, 1918:—

Colony.	Quantity, lb.	Estimated value, £.
Grenada	nil	
St. Vincent	144,741	24,124
Barbados	135,865	20,380
Montserrat	183,196*	32,231
Antigua	nil	nil
St. Kitts	,,	,,
Nevis	,,	,,
Anguilla	,,	,,
Virgin Islands	7,050†	996
Trinidad	nil	nil
Total	470,852 lb.	£77,731

In addition to the above, there were also exported from St. Vincent 2,841 lb. of Marie Galante seed-cotton, and 221 lb. of native cotton from the Virgin Islands, of the respective estimated values of £59, and £11.

*The cotton shipped from Montserrat was made up of £175,333 lb. of lint, and 31,454 lb. of seed-cotton, equal to 7,863 lb. of lint, making the total lint1 83,196 lb.

†The cotton exported from the Virgin Islands comprised 5,138 lb. of lint, and 7,650 lb. of seed-cotton, equal to 1,912 lb. of lint, making the total lint 7,050 lb., as shown above.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended May 4, 1918, is as follows:—

ISLANDS. We have had a continuance of the quiet market throughout the week, with only a limited inquiry, resulting in no sales.

The Factors are becoming more anxious to sell the small stock remaining on hand, but do not express any willingness to make any concessions in price. Therefore we have to renew our last quotations.

We quote, viz:—

Extra Fine 75c. to 80c. = 77c. to 82c., c.i.f.
Fine to Fully Fine 73c. to 74c. = 75c. to 76c. ,,
Fine to Fully Fine, off in preparation, 70c. to 71c. = 72c. to 73c., c.i.f.
Fine to Fully Fine, stained, 65c. = 67c. c.i.f.

GEORGIAS AND FLORIDAS. The demand has continued in a limited way in Savannah and the interior markets on a basis of Average Extra Choice 72¼c., resulting in sales of several hundred bags on account of the Northern Mills. The purchases are still made with the understanding that the seller will carry the cotton until freight room can be obtained.

The Steamship Lines are still more or less congested, rendering it difficult to get any freight for prompt shipment.

We quote, viz:—

Average Extra Choice 72¼c. = 74½c. c.i.f.

The exports from Savannah for the week have been, to Northern Mills 225 bales, Liverpool 50 bales, and from Jacksonville to Northern Mills 749 bales, consisting partly of cotton held there on account of the Government.

HOW TO MAKE COTTAGE CHEESE.

Cottage cheese, a most palatable and nutritious product, is one of the few varieties of cheese which can be manufactured on a small scale. It furnishes a convenient and economical means for using skimmed milk as a human food. The following directions for making it at home are taken from *Farmers' Bulletin*, No. 850.

The first consideration in the production of good cottage cheese is the quality of the milk itself. The fresher the milk the more satisfactory it is for cheese making, because then it is possible to direct and control the souring. For best results, milk should be kept cool at 50°F., or lower, if possible, until it is to be made into cheese.

The most scrupulous care should be exercised in order to keep all utensils sweet and clean.

One gallon of skimmed milk will make about 1½ lb. of cheese. If the milk is sweet it should be placed in a pan and allowed to remain in a temperature about 75°F. until it clabbers. Ordinarily this will take about thirty hours.

As soon as the milk is thoroughly clabbered, it should be cut into pieces 2 inches square, and then the curd should be stirred thoroughly with a spoon. The pan of broken curd is then to be placed in a vessel of hot water to raise the temperature to 100°F. It should be cooked at that temperature for about thirty minutes, during which time it should be stirred with a spoon for one minute at five-minute intervals.

At the conclusion of the heating, the curds and whey should be poured into a small cheese-cloth bag to drain, or the curd may be poured into a colander or strainer over which a piece of cheese-cloth has been laid. After five or ten minutes' work the curd towards the centre with a spoon. Raising and lowering the ends of the cloth helps to make the whey drain faster. To complete the draining, tie the ends of the bag together and hang it up. Since there is some danger that the curd may become too dry, draining should stop when the whey ceases to flow in a steady stream.

The curd emptied from the bag is then worked with a spoon until it becomes fine in grain, smooth, and of the consistency of mashed potatoes. Then the cheese is salted according to taste, about one teaspoonful to a pound of curd.

Because of the ease with which this cheese can be made, it is desirable to make it often, so that it may be eaten fresh; although, if it is kept cold, it will not spoil for several days. If the cheese is not to be eaten promptly, it should be stored in an earthenware or glass vessel and kept cool.

THE VEGETABLE PRODUCTS FACTORY IN DEMERARA.

At a general meeting of the Board of Agriculture of British Guiana held at Georgetown on May 14, 1918, the *Daily Argosy* in its report of the meeting, states that Professor J. B. Harrison, C.M.G., Director of Science and Agriculture, referred to the progress on the Vegetable Products Factory. He said that orders had been placed in the United States for machinery for the purpose of converting rice and corn into flour, and it was hoped that the first shipment of this machinery would arrive in the course of a few weeks. The question of a factory for converting ground provision into flour was a somewhat different matter. It had been necessary for them to plan out all the machinery for such purpose, and the estimated cost in New York was $16,900, which would mean a total expenditure of something like $25,000. The question was whether they were justified at the present time in spending such a large amount.

In connexion with this subject His Excellency the Governor, Sir Wilfred Collet, who presided at the meeting, said that he was informed from Canada that the Canadian Government considered that the requirements of the Colony of British Guiana as regards flour were about 22,000 bags for two months, and licenses had been issued for the exportation of that quantity. As the Colony received 2,500 bags in addition from the United States, they were only 1,500 bags short of their estimated full requirement. For the present at any rate they were better off than had been feared.

Referring to the cultivation of food crops, Professor Harrison stated that in accordance with the Governor's instructions he had distributed about a ton of black-eye peas and other leguminous food crops to farmers.

Food Hoarding.—The Food Commission in England has issued the following statement, dated February 11, 1918: 'It is impossible to give any precise and general definition of food hoarding, or to lay down an exact standard of supply which householders may reasonably hold of the various articles of food. Each individual case must be judged on its merits. It may, however, be taken as a very rough indication of the view of the Ministry of Food, that a fortnight to three weeks' supply of any of the staple articles of food is not regarded as excessive, and, if already purchased, need not be surrendered. Stocks for a longer period may, in special circumstances, be held by people living in districts remote from the source of supply, and subject to exceptional difficulties of transport.

The food hoarding orders do not apply to stocks of any home-produced food, e.g. bacon, jam, bottled fruit, vegetables, preserved eggs and the like. (The *Produce Markets Review*, February 16, 1918.)

The Hawaiian sugar crop for 1917 was 694,663 short tons. The average yield of cane per acre is given for 1917 at 42 tons. This is a wonderful showing, we presume better than can be found elsewhere in the sugar-cane world. In 1875, when the Hawaiian production was but some 40,000 or 50,000 tons, it was seriously stated that it was impossible of being increased beyond 75,000 to 100,000 short tons; it has however for the last three years averaged about 600,000 short tons, or twelve times the production of forty-three years ago, and six times more than the maximum then contemplated. (The *Louisiana Planter*, April 20, 1918.)

THE POST-WAR FARM TRACTOR.

An interesting article on the above subject appears in the *Field*, April 6, 1918, from which the following is taken:—

'It appears to be a common conviction amongs tthose who have had to handle or control the agricultural motor tractor that so soon as the war is over the whole design and construction of these machines will be over-hauled and fresh lines adopted, and we shall expect some British manufacturers to lead the way. In all probability this will be done by fresh entrants into this line of engineering, for it is one of the most difficult operations in commerce to induce or compel a manufacturer to scrap the designs and abandon the constructions he has spent much time and money in producing and selling. The maker of the pre-war machine aimed at producing an all-purpose machine; we now see that such a model has a too limited application and a more limited sale. To construct a tractor efficient for road haulage and farm cultivation means compromising on both points, and the amount of haulage possible with a small tractor makes the compromise inadvisable. The popular tractor will be a machine not intended to do other than haul, plough, and harrow, reaper and mower, drive a threshing machine, and undertake other similar work. Haulage will be done by a light lorry, of which we make no doubt that a number specially designed for farm use will be on offer. The post-war farm tractor will have a true engineering lay-out, as distinct from the present very inefficient form of exposed gearing, underpowered, overweighted type.

'No less important than the improvement of the tractor must be the improvement in ploughs and other implements designed for use with it. At the moment, the most accepted view is that good tractor ploughing cannot be accomplished at a speed in excess of 3 miles per hour furrow travel, and in order to secure a maximum efficiency, the number of shares in operation is calculated to admit no greater rate of travel. We are not at all satisfied that this is a sound conclusion. We do not deny the wisdom of the circumscribed speed to-day, but we greatly question its acceptance in the near future. The speed of the tractor is governed by the design of the plough.

'But if the plough be designed for a speed of 4 or more miles per hour, there is no reason to apprehend that it would not give results equally satisfactory with the present slow speed instrument. The history of the marine screw propeller leads us to surmise that the ploughing efficiency of the high speed tractor will be found to depend more on the design of the plough fitted than on the quality of the tractor or its drivers. Once this theory is established and proved correct in practice we may expect to see high pressure ploughing such as at present would be regarded as impossible. The times rightly demand an improvement in the design and construction of farm tractors, but even more urgent still is improvement in the implements with which it has to work. We are confident that considerable strides can be made in this direction by careful, methodical, and exhaustive experiment which might well be subsidized by the Government in order that patentees may not be able to impose a heavy tax on the use of the improved implements. In all probability it will be found that each different quality and consistency of soil will require its own special type and design of high speed plough or other tackle, and it is for that reason we would ask for State assistance in order to shorten the time of evolution, and to prevent the farmer from being made the trial horse for the agricultural engineer.'

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

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Entomologists	H. A. Ballou, M.Sc.† J. C. Hutson, B.A., Ph.D.
Mycologist	W. Nowell, D.I.C.
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Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial discusses some aspects of importance in organization applied to some West Indian agricultural industries.

The subject of the value of zoology to human welfare is continued under Insect Notes, on page 170.

The important subject of plant sanitation, exemplified in the organization of the Commission of Plant Sanitation in Cuba is dealt with on page 174.

The characteristics of the prominent breeds of dairy cattle form the subject of an article to be found on page 164.

The Jamaica Imperial Association.

This association, recently formed in Jamaica, seems to be likely to accomplish very good work. It is an important association of large landowners, who are anxious to form sound public opinion, to work together in their industries, to keep such records and accounts on a common basis as will serve for the economic study of their work with a view to development, and to help in the proper development and government of the colony. It is probable that there will be internal groups dealing with the principal industries, such as sugar, bananas, stock raising and dairying, cacao, etc. These groups will be able to gather valuable information as to the condition and needs of the several industries.

The Tanning of Fish Skins.

An article in the *Agricultural News*, February 23, 1918, noticed the demand for certain large fish skins for tanning purposes, to which Messrs. H. S. Bernard & Co., of New York, had drawn the attention of this Department.

The same firm has recently written, stating that in preparing fish skins for the market the fish should be cut open along the back, and not along the belly. so as to preserve the full skin. They also mention that the fish in which they are especially interested, and the skins of which they could use in any amount, are the so-called spike sharks, for which they would pay at the rate of 10c. per lb.

Johnson and Sudan Grasses in Barbados.

A note received from Mr. R. Foster Parkinson, of Barbados, gives some useful information on his experience in the cultivation of these grasses. Although somewhat alike in appearance, these two fodder grasses differ much in habit of growth. Johnson grass develops long creeping rhizomes from which it sends out fresh shoots in the same manner as devil's grass. This makes it very difficult to get rid of when once established. Mr. Parkinson says, in fact, that the more you dig it up the better it grows, although when left entirely alone, and allowed to be grazed by goats, he noticed that it was killed out in a few months. All stock are exceedingly fond of this grass, but if not cultivated twice a year little yield is obtained from it. Mr. Parkinson has been growing it for about five years.

The Sudan seed was imported last year, and Mr. Parkinson reports most favourably on the results obtained up to the present. This grass has a great power of withstanding drought, but it will require good cultivation, and should be replanted after several cuttings. It is planted, like Guinea grass, by dividing the clumps; one plant will grow into a huge clump, a foot in diameter at the roots, and as high as 7½ feet. Even in dry weather the grass can be cut about every six weeks, although, of course, it does not grow as tall as in rainy weather.

With reference to the above, it is to be noted that Johnson grass is a serious weed of arable land in some parts of America, and on account of its spreading rhizomes has proved a very great nuisance and

source of expense at Union, St. Lucia, where it was introduced some years ago. Apparently under Barbados conditions Johnson grass is not so troublesome. With the case of devil's grass in mind, however, it may be as well to be cautious in extending its cultivation.

Blackie's 'Senior Tropical Reader'.

The *Senior Tropical Reader*, by Sir Francis Watts, K.C.M.G., D.Sc., Imperial Commissioner of Agriculture for the West Indies, and the Rev. C. H. Branch, B.A., working in collaboration, has been added to the well-known series, Blackie's Tropical Readers, with a view to placing in the hands of young people in tropical lands a more advanced book than the series has yet contained. The general theme of the book may be expressed as being the story of the linking together of the tropics and the lands of the temperate zones through exploration, trade, and commerce. The book is written specially from the point of view of young people who live in the tropics, but will be found to form highly instructive and interesting reading also for pupils in temperate lands.

The *Senior Tropical Reader* forms a handsome volume printed on excellent super-calendered paper. It is freely illustrated with photographic and other pictures.

The earlier numbers of the Tropical Reader Series are too well known to require description. They were produced originally for the Board of Education, Jamaica, and have proved their usefulness for schools in all tropical countries.

Onions in Dominica.

In a letter recently received from Mr. Joseph Jones, Curator of the Botanic Garden, Dominica, an interesting account is given of some experiments in planting onions in that island at Spring Hill estate. Mr. E. J. Seignoret, the owner of that estate, left in the seed-bed a number of onion seedlings of the sowings made in September 1916. He only took steps to transplant them after the dry weather had come on. Owing to the dry season these seedlings remained as 'sets'; these were later on lifted, dried, and stored until November-December 1917, when they were planted out. During the month of March 1918, full sized onions were reaped from this planting. Thirty of the onions, moreover, were then producing seeds.

The observations made by Mr. Seignoret may prove to be of considerable importance to the onion industry in these islands, (1) as to the feasibility of regularly producing onions out of season by delayed transplanting, and (2) as to the local production of seed.

It is hoped that the seed so produced will be carefully saved, and tried in comparison with Teneriffe seed at the regular planting season.

On April 9, 1918, Mr. Jones forwarded a sample of these onions to this Office. It was in excellent condition, of good form and size, and also of capital flavour. It measured 3 inches in diameter, and weighed 5 oz.

The National Physical Laboratory.

In a lecture at the Royal Institute on February 26, 1918 which was noticed in the issue of *The Times* of the next day, Sir R. T. Glazebrook gave some particulars concerning the future of the National Physical Laboratory.

He explained that hitherto the control of the laboratory had rested with the Royal Society. Indeed it had really been a private concern of the Royal Society, dependent for part of its income on a grant-in-aid from the Treasury. From April 1, however, its property will be vested in the Imperial Trust for the Encouragement of Scientific and Industrial Research, and its income will be vested in, and be under the control of the Committee of the Privy Council for Scientific and Industrial Research.

In the future, as in the past, the laboratory will endeavour to discharge the two functions of being a laboratory of industrial research, and a national testing institution. It will be organized in eight different departments, each with its own superintendent and a large staff of scientific assistants and observers. The staff now numbers over 600 persons, of whom about 180 are women. The expenditure, which was £5 479 in 1900, will be considerably over £100,000 during the current financial year.

This appears to be a welcome sign of the increased interest and attention that is being paid to scientific research by the British Government.

Trinidad's Food Supply.

In an article on the above subject, which appears in the *West India Committee Circular*, April 4, 1918, it is pointed out that Trinidad, owing to its proximity to the mainland, is in a better condition than the other West Indian islands as regards food supply. It is true that the removal of two of the steamers of the Canadian Royal Mail will doubtless in time make a serious difference in the supply of flour and other foodstuffs from North America. Up to the present, however, there cannot be said to have been any real shortage.

Bread substitutes are being more used, and locally grown provisions more extensively planted. Trinidad could easily be self-supporting in the matter of food, but the fact that the cultivation of cacao and cane has in the past paid better, has led the people of that island to import vegetables rather than to cultivate them themselves. Owing to the island's proximity to Venezuela, where there are practically unlimited numbers of cattle, there is no fear of a shortage in the supply of meat. From the same country also, cargoes of plantains are constantly being imported, together with a large quantity of Indian corn. Of course the prices of all foodstuffs have risen, but there does not seem, fortunately, to be any reason to think that there will be any real dearth in the near future.

This condition of affairs seems to be largely due to the unwearying exertions of the Acting Director of Agriculture, Mr. W. G. Freeman, who has been lecturing in every district of the island on the necessity of more extensive local food production.

INSECT NOTES.

THE VALUE OF ZOOLOGY TO HUMAN WELFARE.

In the last number of the *Agricultural News* reference was made in this column to a symposium held by some of the leading zoologists of the United States at which papers were read under the above general title, and to each speaker was assigned that particular branch of zoology in which he himself is a recognized authority. An account was given of a paper by Dr. L. O. Howard, on the advantages which humanity has gained from the work of those zoologists who study insects. In the present issue it is proposed to touch briefly on the part that zoology has played in the modern history of the fishing industry in the United States, as it has been so ably and concisely sketched by Dr. H. M. Smith, of the Bureau of Fisheries. His address appeared in *Science* for March 29, 1918, from which account the following notes are taken.

In the opinion of Dr. Smith, 'It is doing no violence to truth or justice, to claim that the beginnings of a sane and beneficent fishery administration in the United States date from the time when a man, already eminent in Science, with many years experience in zoological work' was appointed to investigate the position of the food-fishes of the coasts and lakes of the United States, and to take all measures necessary for their conservation.

'Since that year (1871)', Dr. Smith continues, 'when Baird began those masterly and far-sighted inquiries, zoology has been the constant forerunner or associate of fishery progress; and the conservation of the resources of our lakes, rivers, and coastal waters became an established policy and an accmplished fact many years before the term conservation came into general use as applied to any other resources.'

From the first it was recognized that a complete knowledge of aquatic creatures was essential for putting the administration of the fisheries on a sound basis, and that this knowledge must be acquired by minute investigations into the biology of the various forms, important or otherwise, connected with the fishing industry.

Baird was successful in drawing round him a large body of men trained in the methods of zoological research, and the success of the work all through has been largely, in many cases entirely, dependent on the services of zoologists.

It may not be out of place to mention a few special cases, out of the many which might be cited, in which zoology has rendered conspicuous and noteworthy service.

The zoologists, Brooks, Ryder, and others, through their studies of the biology of the oyster, and from experimental work in oyster breeding have given enduring aid in solving many of the practical problems of the oyster industry. 'With the oyster, as with other water creatures, the teachings of zoology have been at complete variance with the confirmed practices and deep-seated prejudices of certain States. The welfare of their oyster industry was for a long period neglected; and the delivery of these States from the thraldom of absolute, efficient, and wasteful methods has depended on their eventual willingness to accept zoological facts as the basis for administration.'

Again, the lobster industry has suffered from the failure or refusal of certain States to recognize the elementary needs of the lobster as set forth by the investigations of Herrick. In the opinion of Dr. Smith, had these States been willing to be guided by the teachings of zoology, the lobster, instead of being the rare and expensive article of food that it is to-day, could have been made a staple, moderate-priced food for all time. One redeeming feature is the adoption in Rhode Island of a system of artificial rearing devised by the zoologist Mead, which has enabled that State to maintain a better lobster supply than any other State in the Union.

A further illustration of the application of zoology to the public good is the prompt use made by the American Government of the results of the investigations of Lefevre and Curtis on the habits of the glochidia, or larval stage, of the pearly mussels. The establishment of an expensive laboratory for continuing these investigations, and the maintenance of an adequate staff for applying the results of zoological researches and experiments have been of conspicuous practical value in preserving this great industry, which supports many thousands of people.

The writer also refers to the recent studies of the scales and bones of fishes as a result of which it is now possible 'to substitute facts for guesswork in formulating protective fishery laws bearing on the size and age of food and game fishes.'

A final example of the enduring services which zoology has rendered to humanity is given by Dr. Smith in the following words: 'A year or two ago there arose a situation in one of the largest sea-board cities where ill-advised administrative action threatened to exclude from the market one of the most abundant and wholesome marine fishes, with consequent disturbance of long-established trade, and serious loss to the fishermen even of remote regions. A real disaster impended because a market inspector saw certain parasites and misconstrued their significance. The evil was averted by the ability of the government to recommend to the city authorities a zoologist with a most convincing mass of zoological evidence, with the result that the embargo was promptly lifted and in all probability will never again be placed in that community for such a reason.'

The writer considers it a hopeful sign for the future that more and more reliance is being placed by the public on the recommendations of zoology in the handling of fishery questions.

J.C.H.

THE FOOD QUESTION IN JAMAICA.

In a *Gazette Extraordinary*, the late Governor of Jamaica, Sir William Manning, has issued an appeal to all classes in the island to join in increasing the local food production. The following is the text of His Excellency's appeal:—

'The Governor desires to invite the full co-operation of all sections of the community in the matter of increasing the food production of the island, and with this object in view asks that all landowners, both great and small, and also small settlers, should fully inform themselves of all that has been done in order to increase food production, and that they themselves should, without delay, take every possible means of increasing the food supply of the island.

'His Excellency is of opinion that all Ministers of Religion could greatly help in the matter, and would be glad if they would do so by bringing to the notice of their congregations the urgency of the food situation, and on each Sunday address to their congregations some remarks to the effect that the necessity for food production will grow as time goes on; that the situation will no doubt be rather worse when the war ends: that not only for feeding themselves

but for patriotic reasons they should help England to win the war by endeavouring to make the island self-supporting in regard to food supplies, thereby releasing such food as may be available for use elsewhere, first of all for feeding the army, which is fighting for the liberty of the world, and then to feed the women and children of the Allied countries, who now are receiving only barely what is sufficient to keep them alive.

'His Excellency desires to point out that there is no finality in the proposals which are now being put forward, but that these are merely a commencement of endeavours which should result in general development as time goes on, and possibly in the establishment of an industry which will be of general benefit to the island, in so far as much of the foodstuffs now imported into the island could be produced locally, to the advantage of those who could produce them.'

BANANA BREAD IN JAMAICA.

The United Fruit Company have recently issued in Jamaica a circular, pointing out that the employment of a large proportion of boiled bananas in bread will be an easy way of helping to meet the threatened shortage in flour. The following is the recipe in the circular:—

'If you will substitute for the precious grain, the fruit that you have known from childhood, the green banana, in proportions of 30 per cent. of this fruit and 70 per cent. of flour, boiling the absolute green bananas in salted water, and mashing the bananas, adding to the dough 30 per cent. of its weight of the mashed boiled bananas, you will produce a bread which is both palatable, and hard to distinguish from all-wheat bread, though darker in colour.'

At the same time that the company issued this circular they sent out samples of bread made in the manner recommended It is reported in the Jamaica *Gleaner*, April 22, that the loaves turned out were excellent in flavour, and as palatable as any wheaten bread. Sir Francis Watts having tried this bread gives his opinion that it was of good flavour, and had no unusual taste, so that the presence of the bananas was not noticeable. The bread had however a somewhat dark, bluish-grey colour, which may be thought objectionable by some people. He thinks that this colour is due to changes brought about by enzymes, and that it might be avoided by throwing the green bananas into *boiling* water *immediately* the skins are removed, and that in this way a still more acceptable bread would result. It might be tried in other of these West Indian islands.

The question is one of considerable importance to Jamaica, where immense quantities of bananas are available, in connexion with the export of which there may be some difficulty in finding shipping. Large quantities of bananas might thus be used locally, and a great saving be effected in connexion with the importation of flour.

In order to introduce the bread, the United Fruit Company have offered to furnish, free of cost to responsible bakers, a reasonable supply of green bananas for experimental purposes.

The proportions of bananas to flour advised in the circular quoted above may perhaps be more readily grasped if it is stated that 3 lb. of boiled, mashed green bananas should be mixed with 7 lb. of dough made from wheaten flour, the whole being worked up into 10 lb. of dough to be made into loaves for baking.

Probably the recipes for preparing potato bread already given in former issues of the *Agricultural News* would suit for the preparation of this banana bread.

THE CABBAGE PALM FRUIT AS A FOOD FOR HOGS.

It has long appeared to the writer of this note that the fruit of the cabbage palm (*Oreodoxa regia*) might be utilized as a food for animals, especially hogs, in those of the West Indian islands where the palm is abundant. In the *Revista de Agricultura, Comercio y Trabajo*, March 1918, the official publication of the Department of Agriculture, Cuba, an interesting article appears on this subject written by Dr. E. Moreno, Chief of the Chemical Department of the Agronomic Experiment Station in that island.

Dr. Moreno has undertaken careful analyses of the fruit of the cabbage palm in order to ascertain its food value, and the possibility of its employment for feeding hogs, or for other industrial uses.

The analyses show that the quantity of oil contained in the fruit varies within large limits—between 12 and 32 per cent. Although this oil content does not allow the cabbage palm to be placed in the first rank of oleaginous nuts, it is interesting, nevertheless, as showing in a conclusive manner the value of the fruit for feeding and fattening hogs.

After detailed analyses of the rind, the pulp, and the nut separately, as well as of the complete fruit, Dr. Moreno comes to the conclusion that the best results are obtained from the perfectly ripe fruit, when it has acquired a dark purple colour, and that as a foodstuff for hogs, the complete fruit in its fresh state is superior to the dried article, whether sun-dried or dried by artificial means.

The reasons for this judgment he gives as follows. Although the greatest part of oil is contained in the kernel yet there exists in the mesocarp (the pulp) a considerable quantity of oil, along with watery juices; the rind also, although very poor in oil content, is relatively rich in protein. In the rind there has been proved to exist also the presence of a stimulating principle of a slightly acid and fermentable nature, analogous to that contained in mustard and other piquant seeds, which without doubt acts as an enzyme or ferment, stimulating, and assisting the digestibility of the cabbage palm nuts. Therefore the conclusion is arrived at that the cabbage palm nuts should be fed entire to hogs without stripping them of their rind, and preferably fresh, or at least air-dried, because further desiccation tends to get rid of the stimulating principle, which has been mentioned.

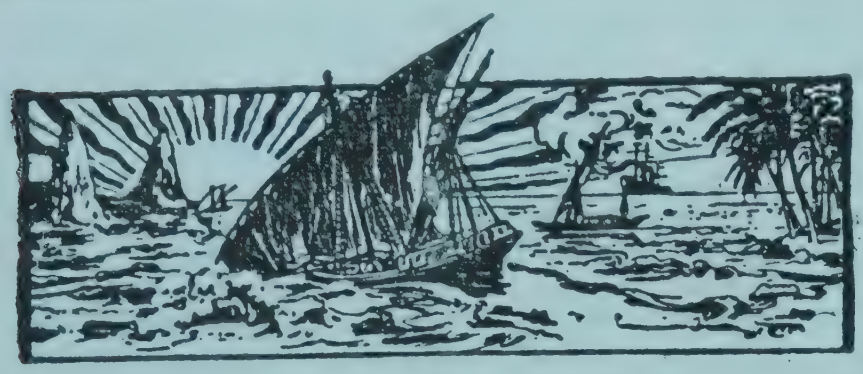
The following table gives the average composition of the fruit:—

	Fresh.	Air-dried.	Stove-dried.
Water	42·27	16·78	
Oil	17·33	21·16	26·55
Protein	3·43	4·38	6·08
Carbohydrates	20·93	32·84	39·47
Fibre	12·79	20·79	23·57
Ash	3·25	3·58	4·33

The following table is given as representing the comparative food value, expressed in Calories, of cabbage palm fruit, alfalfa hay, cowpea hay, and maize:—

Cabbage palm fruit	348·24	Calories
Alfalfa hay	223·86	„
Cowpea hay	180·01	„
Maize	374·10	„

The above shows that the cabbage palm fruit compares favourably with many other foodstuffs which possess considerable reputation.



GLEANINGS.

The extraordinary price of £236 per ton has been paid for flax in Dundee. The flax was part of a consignment damaged by water, and this is perhaps the highest figure ever paid for the fibre. (*The Times*, February 28, 1918.)

The future position of the world's sugar as regards production and distribution depends entirely upon the position of the British Empire in the direction of fostering sugar production, and upon the future attitude of the United States towards its protective policy in that direction. (The *West India Committee Circular*, April 4, 1918.)

The *Louisiana Planter* for April 20, 1918, says that Canada is coming to the fore with her maple sugar production. It is reported that the output for the present season will be 40 million lb. with 4 million gallons of syrup. It is estimated that at the present prices of maple sugar and syrup this crop will be worth close on to $10,000,000.

The average price being obtained for plantation rubber is lower than it has been for quite a long period, and, in view of the continued rise in the cost of most estate requisites, and the restriction of output leading to a higher cost per lb. of raw rubber collected, the total profits from plantations will be appreciably affected. (The *India Rubber Journal*, April 6, 1918.)

The Japanese are very fond of the 'Morning Glory' (*Ipomea* sp.), of which they have a great number of varieties. They grow them in pots for house and table decorations, and keep them compact by pinching off the climbing stems. The result is a compact bush from 1 to 2 feet high which bears from two to five blooms a day. (The *Egyptian Horticultural Review*, January 1918.)

Bees-wax is not suitable as a seal for bottled fruit because it shrinks in cooling, leaving a space through which air with the germs of decay can penetrate. The best preservative for household use is the tasteless paraffin oil now largely used for medical purposes. The oil may be removed by means of a salt spoon when the fruit is required for use, and may be utilized again for the same purpose. (The *Field*, April 13, 1918.)

Radio-activity is normally a factor of plant environment; it has been shown that freshly fallen rain and snow, soil, common rocks, soil air, and in fact practically every kind and form of matter is more or less radio-active. Radium, however, is not a plant food, and the necessity of fertilizers does not seem to be decreased by its application to the soil. (*Memoirs of the New York Botanical Garden*, August 1916.)

According to *Nature*, April 11, 1918, the *Bulletin des Usines de Guerre* for March 18, gives particulars of a motor car propelled by hydrogen, which is probably the first of its kind. Experiments made with the vehicle show: (1) that a car motor can be made to work perfectly well with a mixture of pure hydrogen and air; (2) that it is not necessary to modify the construction of the motor; and (3) that the motor can be worked with a simple type of carburettor.

In a note on the demand for onions in the *Field* for April 27, 1918, it is stated that in 1914 no less than 7,499,313 bushels of foreign-grown onions were imported into England. It is strongly urged that more extensive cultivation of this indispensable vegetable be undertaken. For culinary purposes it may be said to be in almost hourly demand. For small holdings the onion is a most valuable crop, as there is no vegetable that better repays care in cultivation.

The Board of Trade Journal for April 11, 1918, draws attention to the appointment of Mr. A. J. Pavitt, as His Majesty's Trade Commissioner in Trinidad. Mr. Pavitt will have within his sphere of duty the whole of the British West Indian islands and a number of adjacent foreign West Indian islands, as well as the British, French and Dutch Guianas. His services are placed at the disposal of British firms who are desirous of extending or developing their export trade in the area included within his sphere of operations.

The *Journal of the Royal Society of Arts*, April 5, 1918, has a note on the exploitation in Argentina of a new dye material 'algarobin', obtained from the wood of the Carob tree (*Ceratonia siliqua*). The material is said to be giving good results in its industrial use, in addition to being economical in comparison with other dye material. Algarobin imparts a light brown colour to any textile fibre, cotton, wool, silk, etc. In combination with other vegetable extracts, such as fustic, logwood, etc., it gives a number of varied and fast colours.

Guinea grass, a native of tropical Africa, is cultivated at the present time for forage purposes practically throughout the tropics. Its introduction into the Philippine Islands only dates from 1907, with the shipment of twenty root-clumps from Hawaii to Manila. It is estimated that at the present time—1917—the twenty root clumps received in 1907 are now the parents of some millions of plants distributed throughout the archipelago, the crop being in high favour as a forage for horses and cattle. (The *Tropical Agriculturist*, February 1918.)

For some time the deposits of monazite sand in Brazil were the only commercial source from which to obtain commercial supplies of thorium required for the manufacture of incandescent gas mantles, but this monopoly was broken up by the discovery of deposits of monazite in the native State of Travancore, India, which was found to contain nearly twice as much thorium as the Brazilian monazite. As a result of the recent mineral survey being conducted in Ceylon, there has also been discovered valuable deposits of monazite sand in that island. (*United Empire*, April 1918.)

SOME CITRUS CONDITIONS IN FLORIDA, CALIFORNIA, AND CUBA.

The importance of the citrus cultivation in Florida and California may be judged from the fact that, according to the census of 1910, Florida produced in round numbers 5,970,000 boxes, and California 17,300,000 boxes of citrus fruit that year. In a paper by Professor Howard S. Fawcett, Citrus Experiment Station, University of California, published in the *Monthly Bulletin* of the State Commission of Horticulture, September 1916, some comparisons are drawn between the conditions of the industry in these two States, and also of the same industry in Cuba.

Florida's principal rainfall (40 to 60 inches) comes chiefly in the summer months. In contrast to this, California's principal rainfall (10 to 25 inches) is in the winter or early spring months. This is why citrus trees may be grown in Florida mostly without irrigation, while in California the industry is almost entirely dependent upon irrigation. The greater summer humidity of Florida tends, however, to the development of certain types of fungus diseases which are absent or negligible in California.

A comparison of soils shows great variation in both States. Generally speaking the soils in Florida are more deficient in the elements of plant food than those of California. An artificial supply of water is the prime necessity in California, while fertilizers are the prime necessity in almost all types of soil in Florida.

In Florida, within every citrus-growing section, with few exceptions, the individual orchards are scattered, and not in continuous, almost solidly planted areas, as are commonly seen in California. One reason for this scattered condition within a region well suited for citrus cultivation is that since there is no need for general irrigation, there is no necessity for close co-operation in the formation of irrigation districts.

The practices in cultivation of citrus orchards prevailing in Florida and California differ to a considerable extent. In Florida, cultivation is usually discontinued during the heavy rains of the summer, and only put into practice after the rains are over. During this drier part of the year the cultivation on most soils is very shallow. Some growers use a definite cover crop in summer, while others simply allow grass and weeds to grow during the rains. If these grow too high and rank, they are mowed down, and usually left as a mulch on the ground. On some of the lands no cultivation at all is practised, apart from merely hoeing the weeds that come up under the spread of the trees. Many such orchards without any cultivation are thrifty and profitable. Professor Rolfs, Director of the Florida Experiment Station, says that some of the best groves in the State are heavily sodded with Bermuda grass, and are not cultivated. This is quite different in many respects from the general cultivation practised in California, where in the summer the ground is prepared for irrigation every one or two months, and instead of a cover crop being grown in California in summer, it is usually grown in winter during the period of rain.

The varieties of citrus fruits generally grown differ greatly in the two places. In Florida there are probably twenty to thirty or more different standard varieties of oranges, but in California there are only three or four grown. In California nearly all oranges are classified under the three names, Navel, Valencia, and Seedlings, while in Florida a much larger number of varieties are grown, and many names are in use.

The Washington Navel has apparently never become a successful orange in Florida, though it has been tried repeatedly. Usually the trees of this variety in Florida do not bear well, and the fruit tends to become too large, and in most locations to be lacking in juice. This also seems to be the case in the West Indies where the Washington Navel has been tried.

What has been said as to the large number of standard varieties of oranges cultivated in Florida is also true with regard to grape fruit varieties. Commercially speaking grape fruits are to Florida what lemons are to California.

Lemon growing, such an important branch of the citrus industry in California, is practically non-existent in Florida. The last commercial lemon orchard of 40 acres was budded over in grape fruit about 1911. It is said that the main reason why lemon growing was discontinued in Florida was that the fruit grew too large for the taste of the market. Another reason was that lemons in Florida are apt to be severely attacked by the rust mite.

The citrus stocks mostly used in Florida appear to be sour orange, rough lemon, and grape fruit; in California the principal stocks used are sweet and sour orange. Sour orange is probably used more in Florida than any other, and is also now being used extensively in California, because of its great resistance to gummosis. For years it has been noted for its resistance in Florida to the foot-rot or mal-di-gomma there. The same resistance to this disease on the part of the sour orange has also been noted in some of these West Indies. In Dominica for instance, it is well known that unless grafted on a sour orange or rough lemon stock, no sweet orange tree is able to live many years without succumbing to gummosis. In Florida the rough lemon is preferred by some because the scion appears to grow more vigorously during the first two years. It is also said to be able to stand drought better than other crops. An objection has been made to the rough lemon stock in that it appears in many cases to cause the fruit, at least for the first few crops, to be coarse, pithy, and dry.

It is estimated that in 1913 there were about 20,000 acres under citrus cultivation in Cuba and the Isle of Pines, about 14,000 acres being in grape fruit, 5,000 acres in oranges, and 800 acres in lemons. The citrus chiefly exported from Cuba is grape fruit, oranges being chiefly grown for local consumption, and little attention being now paid to lemons. The lemon orchards are being now budded over to other citrus varieties. The Cubans themselves eat very little grape fruit, but are very fond of what may be termed oversweet, insipid oranges. It has been estimated that the city of Havana alone consumes an average of 100,000 such oranges daily the year round. The citrus growers of Cuba have one great advantage over most of the citrus regions of Florida and California, namely, the total freedom from loss owing to frost.

The method of cultivation in Cuba varies from no cultivation at all to clean cultivation throughout the year, or mulching, and growing of cover crops. Practical experiments as to the difference between mulching and not having any cover on the ground at all for a period of seven years have shown the great benefit to citrus trees in Cuba of the practice of mulching. Professor E. S. Earle believes that the secret of success of mulching is largely due to the shading of the soil. He is of opinion that in hot weather the sun interferes with the work of the soil bacteria, and so prevents the formation of humus. It is a frequent practice to place vegetable mulch directly beneath the trees, and to cultivate and raise cover crops between the rows.

The pigeon pea (*Cajanus indicus*) seems to give excellent results when grown between the rows of young trees, not only in shading the soil, but in serving as a partial windbreak.

THE ORGANIZATION OF PLANT SANITATION IN CUBA.

Bulletin No. 1 of the Commission of Plant Sanitation in Cuba contains orders, reports and correspondence pertaining to the establishment and operations of the Commission, which was constituted by presidential decree in 1916

The relation of knowledge regarding infectious diseases and pests of plants to agricultural industry affords a number of administrative problems which are as yet only in course of being worked out. The rapidly extending appreciation of the importance of plant sanitation within a given country, and of protection against plant pests and diseases from without, is leading in many cases to the creation of a new function of governmental activity, comparable to that which has long been exercised in connexion with the public health.

From this point of view the constitution of the Cuban organization is of general interest. The Decree establishing the Commission is as follows. It is resolved:—

FIRSTLY. To create in the Department of Agriculture, Commerce, and Labour, a commission to be called the Commission of Plant Sanitation, pertaining to the Office of Agriculture, composed of three members, namely, J. R. Johnston, Pathologist of the Agricultural Experiment Station, as President; Patricio Cardin, Chief of the Department of Entomology of said Experiment Station; and Mario Sanchez, Professor of the Agricultural School of Havana, in order that the following may be carried out:—

A. To study the diseases and insects that are present or that may be present in the plants in whatever part of the national territory.

B. According to the studies made, to take, with the approval of the Secretary of Agriculture, without other requirement, the prophylactic measures that may be considered necessary in order to combat the diseases, using the resources that will be mentioned further on.

C. For the organization and direction of the work relative to the measure referred to in paragraph B preceding, the Commission may send any of its members to any place it is considered necessary, for which purpose the President of the said Commission will issue the necessary transportation requests, a book of which will be issued by the Secretary of Agriculture, Commerce, and Labour, and during the time that they remain away from the Office on official business, they will receive a per diem allowance of five dollars, which will be paid by the Secretary from the funds placed at his disposal in a succeeding paragraph.

D. The President of this Commission or other member in his absence may order the removal of machinery and other materials, to whatever place is necessary in order to combat the diseases that may appear in any plantation

E. In the same way, the Commission, the member who undertakes the work of disinfection of any crop, or any of the inspectors who have been appointed by the Commission for this purpose with the proper instructions, may proceed to employ labourers to clean or destroy infected plants, and also contract for whatever other service is considered necessary, (first consulting and obtaining the approbation of the Secretary, which should be done in the most rapid manner,) whose wages or expenses will be paid from the funds designated for this purpose, to which end the Paymaster of the Department of Agriculture is especially authorized to facilitate the amount agreed upon, the expenditure of which will be accounted for by whoever receives it, in at most sixty days, counting from the day of its receipt.

F. When the case of infection is of such gravity that only by the destruction of the crop can the plague be exterminated, the Commission will submit the case to the Secretary of Agriculture, Commerce, and Labour, who will take such measures as he considers necessary, both in accord with the owner of the plants and with the necessities of the case.

G. This Commission will meet as often as it may be necessary, and report to the Secretary of Agriculture at least every fifteen days as to the progress of the work, and will study in its meetings, under the auspices of the President of the Commission, the problems of greatest importance.

H. When there is necessity for laboratory work, or any work related to that which is conducted at the Agricultural Experimental Station, the Commissioners may request permission from the Director of said establishment, who will grant it.

SECONDLY. The Secretary of Agriculture, Commerce, and Labour is authorized to impose fines that do not exceed fifty dollars on those owners of plantings who do not fulful the instructions that are given by the Commission to avoid the spread of diseases and insects in the fields where they have appeared, for which purpose there will be conceded the time that is considered necessary.

THIRDLY. For the expense that may be necessary for the purchase of apparatus and other material, as well as for the paying of wages and per diem allowances of inspectors that are appointed for this service, the Secretary of Agriculture, Commerce, and Labour, will appropriate ten thousand dollars from the funds that are credited in the current budget to 'Imprevistos' which sum may be requested by the Paymaster from said department in the form designated by the Secretary, all at once if that is agreed upon, and it will be credited by the Secretary of the Treasury.

FOURTHLY. In accord with the statements in the last paragraph of Article 394 of the Organic Law of the Executive Power, it is authorized to name three inspectors, to whom may be assigned the monthly salary of $150, and when necessary an allowance per diem of five dollars, to aid the Commission of Plant Sanitation, constituted by this Decree, who will put themselves at the immediate order of the said Commission without conflicting with the superior authority of the Secretary of the Department; the terms of employment of these inspectors will last through the fiscal year, if necessary.

FIFTHLY. The Commission named will submit to the Secretary of Agriculture proposals concerning the quarantine regulations that should be made against the importation of plants, and the means that ought to be employed in those cases in which they may be admitted.

SIXTHLY. Said Commission is also authorized to issue certificates for plants destined for exportation.

SEVENTHLY. The Secretary of Agriculture, Commerce, and Labour will see that this Decree is fulfilled.

The correspondence regarding foreign quarantine regulations affecting Cuba gives evidence that a careful and comprehensive survey of the island has shown that citrus plantations are free from canker; the possibility is not excluded that it may exist on some of the thousands of trees scattered about in gardens, but no evidence of it has been found in the inspections made.

The diseases of plants in the island to which attention is principally being given by the Commission are the coco-nut bud-rot, and the Panama disease of bananas. The adoption of the recognized measures of control is compulsory in both cases, and inspectors are detailed to see that they are effectively carried out.

Reference is made to a troublesome pest known as the marabu (*Dichrostachys nutans*), a leguminous shrub closely resembling the acacias. It is indigenous to Senegal but has become firmly established in Cuba. It takes possession of land, forms a dense spiny impenetrable growth, and in some cases has compelled the diversion of roads and the removal of houses.

Numerous remedial measures, stimulated by the offer of a reward, have been suggested and tried, including cutting, burning, poisoning, the use of bacteria, fungi, insects, and twining plants, none of which appears so far to be regarded as affording an adequate remedy.

W.N.

BAUXITE IN BRITISH GUIANA.

The geological and analytical examination of the soils and rocks of British Guiana, carried out during some years past by Professor Harrison, C.M.G., Director of Science and Agriculture of the colony, has led to the discovery of numerous and extensive deposits of bauxite. Some of these deposits have been leased for working to an American company, but the lands already leased by no means exhaust the deposits of the mineral in the colony.

The importance of conserving and developing the bauxite deposits of British Guiana is due to the prominent place that aluminium holds in modern industries, and bauxite is the necessary raw material required for the production of this metal. This importance, it seems, will become greater than ever, because aluminium has become an essential for the motor and aircraft industries.

The manufacture of aluminium from bauxite consists of two stages: (a) the production of alumina from bauxite, which is done by refining bauxite; and (b) the transformation of refined alumina into aluminium by electrolysis, using cryolite as the electrolytic flux.

By feeding alumina into cryolite in electric furnaces of special construction, decomposition takes places, and metallic aluminium is tapped at intervals from the bottom of the furnace. Besides the production of aluminium, fresh uses are constantly being found for bauxite, which seems to have an ever-increasingly wide possibility of application.

Up to the present, Great Britain has been chiefly dependent on France for the supply of bauxite. It is therefore most advisable that all sources of supply within the Empire should be developed and controlled for our own use, so that the British Empire should no longer be dependent on foreign countries for the supply of the raw material. In the manufacture of aluminium the three principal requirements are: (1) cheap electrical energy; (2) bauxite; (3) cryolite. It is true that cryolite in its natural state is only obtainable from Greenland, but on the other hand, this mineral is produced synthetically. With the large deposits of bauxite, and possessing in the Kaieteur Falls a source of electric power greater than that of Niagara, British Guiana is most favourably situated to enable it to become a most important producer of aluminium, and it would be a very short-sighted policy if the deposits of this mineral were to be alienated from the control of the Government, or not utilized for the benefit of the Empire at large.

Sir Francis Watts, the Imperial Commissioner of Agriculture for the West Indies, has for some time believed that there were deposits of this mineral in some of the smaller West Indian islands. Early in this year he forwarded a box of samples of minerals to Professor Harrison for examination. In his report Professor Harrison states that a sample from the small island of Balliceaux, near St. Vincent, consists of a hydrated aluminium silicate with alunite. He says that the finding of the potash and aluminium containing mineral, alunite, the presence of which is indicated by the analysis of the specimen, is of some interest now when available sources of soluble potash salts are of great importance to the Empire.

He advises that a search should be made in Balliceaux for more promising deposits of alunite.

AGRICULTURE IN GRENADA.

A copy of the progress report on the work of the Agricultural Department, Grenada, for the quarter ended March 31, has been forwarded to this Office by Mr. J. C. Moore, the Superintendent of Agriculture.

A scheme to facilitate the Agricultural Department's activities in prosecuting a vigorous campaign against cacao thrips was submitted to the Board of Agriculture, and, with some amplification in special committee, was adopted. A scheme for the erection of a corn drier and granary in Grenada has also been prepared and submitted for the approval of the Government.

Details of work in the Botanic Gardens include results of experiments with onions. Sown in November and transplanted in December, these are reported to have done fairly well. It is observed, however, that had there been universal showery weather during February and March, there undoubtedly would have been a failure as the result of such unavoidable late sowing. Trials in a few private gardens have also given very promising results. It is estimated that about 20 acres, yielding at the rate of 8,000 lb. per acre, would provide Grenada with onions equalling the quantity imported during 1916. If such a yield can be obtained, there is the possibility of establishing another minor industry capable of yielding the growers a good profit, with onions retailing at 3*d.* per lb. With skilled and industrious work, onions from Teneriffe seed should with hired labour, be produced at a cost of one to one-and-a-half cent per lb. The Department is trying to arouse interest in this new industry, to which end an order for 25 lb. of seed from Teneriffe has been placed with the Imperial Commissioner of Agriculture.

Spraying appliances and materials have been imported by the Agricultural Department in readiness for a vigorous campaign against the cacao thrips. Six estates now have suitable spraying outfits, and four others have them on order. In this connexion it may be mentioned that the presence of the black weevil of banana (*Sphenophorus sordidus*) has been recorded in coco-nut plots, and steps are being taken to ascertain its distribution.

Plant and seed distribution for the quarter totalled—plants, 4,658; seeds, 1,700. In addition, 2,000 seed coconuts were imported for planters. The Department obtained 8 tons of yam plants for distribution in May. Ground provisions are still fairly plentiful, with moderately high prices ruling.

Accompanying the foregoing are monthly reports of the Agricultural Instructors for March last. Perusal of these shows steady progress in agricultural pursuits among the peasants, and it is interesting to note that the Department's activities in connexion with the local food crops campaign have been productive of better organization as compared with last year's efforts, and the work is proceeding satisfactorily.

MARKET REPORTS.

London.—The West India Committee Circular, April 4.

Arrowroot—1/-.
Balata—Venezuelan Block, 3/6; Sheet, 3/11 to 4/2.
Beeswax—No quotations.
Cacao—Trinidad, 90 -; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, 195/- to 200/-.
Lime Juice—Raw, 2/6 to 3/3.; concentrated, no quotations; Otto of lime (hand-pressed), 17/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—No quotations.
Rubber—Para, fine hard, 2/10½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., April 27.

Cacao—Venezuelan, no quotations; Trinidad, $12·75 to $14·00.
Coco-nut Oil—$1·50 per gallon.
Coffee—Venezuelan, 13½c. to 14c. per ℔.
Copra—$7·80 per 100 ℔.
Dhal—no quotations.
Onions—$10·00 to $10·25 per 100 ℔.
Peas, Split—$11·50 to $12·00 per bag.
Potatoes—English, $5·00 to $6·00 per 100 ℔.
Rice—Yellow, $12·00 to $12·25; White, 9·50 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., April 23.

Cacao—Caracas, 12¾c. to 13½c.; Grenada, 13¾c. to 14c.; Trinidad, 14c.; to 14¼c. Jamaica, 12¼c.
Coco-nuts—Jamaica selects, $52·00; Trinidad selects, $49·00; culls, $25·00 to $26·00 per M.
Coffee—Jamaica, 9¾c. to 12c. per ℔.
Ginger—15½c. to 20c. per ℔.
Goat Skins—Jamaica, 80c.; Antigua and Barbados, 80c.; St. Thomas and St. Kitts, 80c. per ℔.
Grape Fruit—Jamaica, $2·50 to $3·00 per box.
Limes—10c. to 14c.
Mace—38c. to 45c. per ℔.
Nutmegs—24c. to 28c.
Oranges—$3·00 to $5·00.
Pimento—7½c. to 8c. per ℔.
Sugar—Centrifugals, 96°, 6·005c; Muscovados, 89°, 5·005c. Molasses, 89°, 4·948c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., May 1.

Arrowroot—$12·00 per 100 ℔.
Cacao—$12·50 per 100 ℔.
Coco-nuts—$36·00 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $4·75.

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British Guiana: The Argosy Co., Ltd., Georgetown.
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Tobago: Mr. C. L. Plagemann, Scarborough.
Grenada: Messrs. Thos. Lawlor & Co., St. George.
St. Vincent: Mr. J. D. Bonadie, 'Times' Office.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau.
Montserrat: Mr. W. Robson, Botanic Station.
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St. Kitts: The Bible and Book Supply Agency, Basseterre.
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Canada: Lewis W. Clemens, 81, Yonge Street (Royal Bank Building), Toronto.

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

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Some Applications of Research to the Cotton Industry.

AT a meeting of the Royal Society of Arts, held on April 10, reported in the Society's Journal of May 3, 1918, a most interesting paper on the above subject was read by Dr. W. L. Balls, who is a well-known authority on the application of science to the production of cotton.

Dr. Balls begins by what might appear to many people as a somewhat startling assertion, the truth of which, however, is evident on reflection. He says that the whole technique of cotton manufacture is based upon the properties of single, unicellular seed hairs. The knowledge of the properties of these hairs, the manner in which they are formed, and their behaviour in the process of spinning is necessary that the grower and the user of cotton may work together in order to produce the best results from the raw material. This raw material is not so much the cotton hair itself, but is rather the sex cell of the cotton plant and the embryo arising therefrom.

When the magnitude of the Lancashire cotton industry, and the ingenuity and organization involved in it are considered, that which lies behind it in the shape of agriculture is apt to be forgotten.

The study of the cotton crop is naturally divided into two halves of equal importance. These are (1) the plant itself, and (2) the environment in which it lives.

Any particular plant has certain constitutional capabilities which have been transmitted to it by heredity, and are definitely fixed at the moment of fertilization. Such constitutional potentialities are developed by the interaction which takes place between the organism and its environment.

Many mistakes have been made in agriculture from missing the distinction between the potentialities of a plant, and the effect of its environment. On the one hand, the attempt has been made to grow unsuitable seed in suitable places, and on the other, to plant suitable seed in unsuitable localities.

Cotton research has led in the first place to the study of the preparation, propagation, and cultivation

of pure strains of cotton plants. In the second place arising out of the study of these plants, it has led to the scientific examination of the length of the lint, the full investigation of which has only become possible quite recently by means of a new piece of scientific apparatus.

When in 1905 Dr. Balls began his researches into the course of heredity in cotton, there was a general conviction that the deterioration of the Egyptian cotton crop could be dealt with primarily by breeding new kinds of cotton. Beginning by taking natural seed from single plants of the 1904 crop, and raising small families from these in 1905, an examination of these families showed that the commercially grown seed with which the start had been made was very far indeed from being the seed of 'pure lines'. Although the families raised were quite small, it was most unusual to find a family in which all the plants resembled one another. This fact indicated that the parent plant must have been a hybrid, and that an appreciable amount of intercrossing was taking place under the conditions of the ordinary Egyptian field crop of cotton. The work was extended to determine the chance of crossing compared with the chance of self-fertilization, which was found to be approximately one in ten. This amount of crossing is amply sufficient to contaminate hopelessly any pure line pedigree within a period of only two or three years.

It was then considered more useful to attempt the study of these natural hybrids on Mendelian lines, or better still, by the deliberate making of hybrids for experimental purposes, than to isolate pure lines. Further experimental work was directed to the study of crosses between American Upland cotton and the Egyptian —practically an inter-species cross—rather than to inter-Egyptian crosses. In many cases definite simple rules of inheritance on Mendelian lines were traced through most complex phenomena, and in even more cases most complex inheritance was found in pedigrees, which on the face of them appeared to have been quite simple.

The characteristics of commercial value in cotton such as length, and breadth, and thickness are nearly all measurable. With regard to the inheritance of these measurable features, the difficulty arose that there was not enough known about the effect of environment upon the degree of the manifestation of such characteristics. It was not known to what extent, or in what manner a cotton plant which had inherited long lint hair might have those hairs shortened, or even made longer by the action of environment.

In 1912 a demand from the Agricultural Department of Egypt was made for a new cotton to replace the deteriorated Afifi. After seven years' experience Dr. Balls considered that it was perfectly easy to introduce a new cotton, but that it was one of the most difficult things in the world to predict what the agricultural behaviour of plants in bulk would be from the behaviour of a few parent plants grown on a breeding plot. Again, to introduce a new variety of cotton of an impure strain, however slight the percentage of impurity, or even to allow it to become contaminated by natural crossing, much less by seed mixture, during its propagation from the breeding plot to field cultivation, was simply to condemn it to the same failure which had sooner or later resulted with every other variety of cotton which had ever been developed in Egypt or anywhere else in the world. This meant that a system of continuous seed renewal was inevitable.

In developing this system, the prime essential was that the strain should be a pure one, and it was undesirable to introduce the use of any but Egyptian stock. The work was restricted to strains which had been obtained by choosing individual plants of commercial Egyptian varieties. These plants and their descendants had been self-fertilized for a number of generations, and all their various characteristics measured, registered, and studied, until such of them as had been hybrids originally had been split down to purity. Four strains were selected, and for two years the energies of the investigators were expended on devising and executing methods whereby these four pure strains could be propagated in sufficient quantity to sow 50 or 100 acres of land, without contamination from other cotton by natural crossing.

Seed mixture and natural crossing can be prevented by the usual research precautions while under laboratory control; and on the propagation plot they can be minimized by surrounding certain areas with a protective belt of plants of the same variety, and only utilizing the seed from the protected plants for sowing. Such a system, combined with a system of seed distribution year by year, would have provided for continual renewal of the seed of the Egyptian crop. The inevitable deterioration of a variety of cotton exposed to contamination in the field would thus be counteracted by renewal from the pure stock. This system of pure strain seed supply was initiated in Egypt, but never carried through to completion.

Natural crossing and therefore contamination of strains must inevitably take place until a cotton plant

is discovered or bred which is naturally self-fertilized. The effect of such mixture is enormously increased year by year. The presence of 2 per cent. of natural hybrids in a handful of seed of pure strain can convert 30 per cent. of the individuals of that strain into rogues at the end of only three years.

Trials were made of the four selected strains: one of them turned out to be definitely superior to any other Egyptian cotton from the agricultural point of view; a second was remarkably good in every spinning test; a third, first selected for propagation as being thoroughly well known, turned out only moderately successful; while the fourth, selected for the length of its lint, although its yield was no better than had been anticipated, showed that Egypt could grow cotton comparable to that of the Sea Islands, if the necessary trouble were taken.

The cultivation of these four strains has now been abandoned, but the importance of guarding against natural crossing has been shown by the fact that, one strain which had been isolated since 1906, and was pure when sown in the field eight years later in 1914, was badly contaminated by 1917.

From the above it will be seen that the ordinary commercial crop of cotton in Egypt, is, from the genetic standpoint, far from being derived from pure strains; there are innumerable differences existing in the plants of a single field. Amongst these are those relating to the length of the lint, over and above such modifications of lint length as may be caused by environment. These genetic differences take two forms: (1) differences in the mean maximum length of the lint produced on any one seed, and (2) differences in the degree of variation in lint length in different parts of the same seed. Consequently a single plant (or equally, a pure strain population of plants) may produce most irregular lint, the hairs from one end of each seed being very much shorter than those from the other end; while every gradation is found between these extremes. On the other hand, suitably chosen pure strains are capable of producing lint more regular in staple than are our present cottons.

The method of obtaining the length of cotton lint from the mean maximum width of the halo made by combing out the fibres gives a remarkably accurate result in measuring lint attached to the seed. The limitation to the method is its inapplicability to ginned lint. A method is now available for dealing with the accurate measurement of ginned lint by a mechanical arrangement, invented by Dr. Balls, which is described at some length on another page of this issue. It seems that this machine would offer possibilities of useful application in all places where experimental cotton growing is carried out. It is possible by the use of it to take a sample of raw cotton, treat it for a few minutes only in an automatic machine, weigh the graduated produce of the machine's activity, and at the end of half an hour to be able to plot frequency curves of a reasonable and measurable degree of precision, showing the variation of length of staple within the sample.

At the conclusion of his paper Dr. Balls pointed out that enquiries, begun with a scientific object, simply to strengthen the foundations of knowledge about the cotton plant, have quite unexpectedly produced results of economic significance. In research of this kind there can be no distinction between pure and applied science. It is really quite immaterial what such research is called, for it is in intention and execution strictly scientific work carried out on an economic material.

ECONOMIC VALUE OF GRASS TREES.

The economic value of grass trees (*Xanthorrhea* spp.) has formed a subject of investigation in South Australia. Attention was drawn to the matter, says the Sydney *Morning Herald* (quoted by the *Journal of the Royal Society of Arts*), on account of the fact that the resin known as yacka gum appears likely to be of considerable commercial importance in the future. Grass trees are not found outside Australia, and they yield products the like of which are not obtained from other plants. The grass tree, it may be mentioned, is a plant with shrubby stems, tufts of long wiry foliage at the summit, and a tall flower-stalk, with a dense cylindrical spike of small flowers.

The only product at present of commercial importance obtained from these trees, is the resin, variously known as gum acaroides, yacka gum, and grass-tree gum. Previous to the present war, by far the greater part of the output of resin was consumed by Germany. The purposes for which it was used are not known with any certainty. Inquiries made in 1910 led to the explanation that it was used in Germany chiefly for the manufacture of cheap furniture polish, and lacquer for metal ware. It is not certain, however, that other uses were not found for it. For instance, it is pointed out that resin derived from a species of grass tree was one of the earliest known sources of picric acid, a yield of 50 per cent. of which was said to have been obtained by treating the resin with strong nitric acid. As picric acid is one of the most widely used of modern war explosives, and was also formerly used to some extent as a dyestuff, an impression has arisen that the resin was being used for picric acid manufacture. Dissolved in methylated spirit the resin gives a spirit varnish of a deep orange-red colour. The core and leaves of the grass tree are further believed to be useful in the production of pulp for paper-making, though it is found somewhat difficult to bleach.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Work in the Experiment Station and Botanic Gardens during March and April was of a routine character, and included the preparation of land for native provision crops. Regarding staple crops, the Superintendent of Agriculture states that the pickings of cacao were decreasing, and the crop prospects not as good as last year. The cane crop was smaller than usual. Ground provisions continued to be fairly plentiful, and increased activity in preparing land for the planting season was evident. The food crops campaign work was progressing favourably. The dry season has been much less severe than last year, and potato and cassava planting has been continued. Mr. Moore mentions that interest in Sea Island cotton growing is taking shape in the proposed cultivation of 200 to 300 acres this year; while the local Agricultural Department advises caution in view of failure of previous trials through boll disease. The rainfall recorded at Richmond Hill during the month of March was 2·49 inches; during April the precipitation amounted to 1·60 inches.

ANTIGUA. Plant distribution during the month of May included—Eucalyptus, 889; limes, 194; onion seedlings, 1,200; whitewood. 24; sweet potato cuttings, 25,000; cotton seed, 1,479 lb. Work in the Experiment Station and Botanic Gardens consisted for the most part of planting operations: rains fell during the month, in consequence of which, Mr. Jackson states, the young crop has considerably improved. There are about 300 acres of cotton planted to date. A moderately large area has been put under provision crops in various parts of the island. The total number of crates of onions shipped was 974. The quantity of seed-cotton purchased by the Antigua Cotton Growing Association to date was 25,967 lb. clean cotton, and 2,505 lb. stains. In consequence of the rains referred to above, which fell throughout the island, the agricultural outlook at the present moment is considerably improved. The precipitation registered for the month was 6·57 inches; for the year, 14·83 inches.

ST. KITTS. According to items forwarded by Mr. F. R. Shepherd, in addition to routine work during the month of May, planting operations were carried on in the Experiment Station and Botanic Gardens. Plant distribution included 20 lb. Mazzagua Guinea corn, 600 *Casuarina equisetifolia*, and 600 cuttings of ornamental plants. The reaping of the sugar-cane crop in the Valley district and on the estates connected with the Factory has been completed. The total crop for the factory has been 7,300 tons of sugar. The return of canes was very poor, ranging from 20 tons to 9 tons per acre, the average being about 12 tons. The young cane crop in the early part of the month was in a critical condition, but a rainfall of about 5 inches at the middle of the month saved the situation. Since then there has been no rain, which is now much needed. The rain enabled growers in this district to plant cotton. The germination has been excellent, but more rain is necessary to keep the young plants alive. In the northern district, where cotton was planted as early as January and February, there are some remarkably fine fields of cotton; all the cotton in fact in that district has made a good start. The rainfall recorded for the month was 6·19 inches; for the year to date, 16·00 inches. From the 13th to the 16th the precipitation registered was 5·25 inches. Since then there has been absolutely no rain.

VIRGIN ISLANDS. Plant distribution during the month of May consisted of 37 cobs of corn and 400 cane plant tops. In addition, 300 lb. of cotton seed were sold. Mr. Fishlock states that considerably more interest is being displayed in the cotton industry than was the case last year. Attention is also being paid to the planting of provision crops. There was little to report otherwise. The weather was favourable, rain falling in measurable quantity on fourteen days. The total rainfall recorded was 6·28 inches, as compared with 4·67, the average for the month for the previous seventeen years.

AGRICULTURE IN BARBADOS.

The month of May closed with a rainfall below the average in the sea-board parishes, but the weather in the other parts of the island has been favourable. In the centre of the island there has been sufficient rain to plant cereals, and vegetables of every kind. Year after year there is a great disparity between the rainfall in the sea-board parishes and that in the inland districts.

The Indian corn recently planted is springing well, and the continued showers will do much to give it a healthy and regular start. In most of Christ Church and St. Lucy the showers have been too light to plant much besides corn, but even in these districts a commendable effort has been made by some planters to sow potatoes. In the more favoured parts of the island some yams have been planted, and also potatoes on a limited scale. The difficulty in these districts has been to get the land tilled, and even with the rains that have fallen the position will not be much changed while the crops are being reaped.

The returns to the Commissioners under the Vegetable Produce Act for the planting of ground provisions have been completed, but the fulfilment of the contracts of the planters will depend upon the goodwill of the labourers.

In the next fortnight the reaping of the cane crop on the black soil will have been completed. On the red soil also many estates will soon be finishing up. There will only be a few windmills which will be grinding beyond the middle of the month.

In spite of the general shortage of yield as compared with last year, there are a few estates on which the return has been very satisfactory. Seedling Ba 6032 still holds the premier record for heavy weight. We understand that this seedling has given a return this year of nearly 50 tons of cane on an estate in St. Andrew's parish. (The Barbados *Agricultural Reporter*, June 1, 1918.)

According to a British Consular Report, there is a small experimental cultivation of sugar-cane in the French zone in Morocco. Four varieties were cultivated in 1916 at the Jardin d'Essais without irrigation, on an area for each variety of 400 metres. The yields obtained from the two of them which were most productive were, respectively, 26 and 14·25 quintals per hectare, with a sugar content of 11·9 and 11·8 per cent. In 1917, however, there was an important falling off both in the yield and in the sugar content, due doubtless to the soil being deficient in plant food, as well as to frost. The trials are being transferred to more suitable localities, and an attempt is being made to import from Brazil varieties better adapted to the conditions in Morocco. (The *International Sugar Journal*, April 1918.)

MATERIAL FOR GENETIC INVESTIGATION IN THE TROPICS.

The study of the inheritance of characters in both plants and animals has now reached the stage where a broad view may be taken of the subject, in so far as it affects the practical agriculturist. When Mendel's law was rediscovered in 1900, it was thought that the application of it to plant and animal breeding would lead immediately to results of the highest economic importance. But as time went on it was seen that in respect of many points, where improvement was urgently necessary, the application of Mendel's law did not lead to the desired results.

One of the most destructive diseases of plants is the rust disease of wheat, which causes an annual loss of many millions of dollars. Ten years ago it was announced that Biffen, of Cambridge, had discovered that resistance to rust is a recessive. It was straightway thought that it would be an easy matter to send out desirable rust-resistant varieties to replace the older kinds. So far as the present writer is aware, no great change has resulted in the varieties of wheat grown by English farmers. The evidence presented by Biffen that resistance to rust is a simple recessive is by no means conclusive, and the work of Nilsson-Ehle has shown that the whole matter may be much more complex. The latter has found that in crosses between two sorts of high resistance there were produced a number of lines, some of which in F_3 proved much more susceptible than either parent.

It is of the highest importance to settle once and for all the way in which resistance to rust in wheat is inherited, and to determine how far such resistance is compatible with economic characters.

So far, little progress has been made in the direction of predicting what will happen when plants are crossed. Some few things we can predict. If a new species of the Leguminosae were discovered in two forms, one with white flowers and another with purple, it would be fairly safe to say that the purple would be dominant over the white, but we cannot go much further. What is needed more than anything else in the science of genetics is an accurate survey of inheritance in a single genus. By an accurate survey is meant the complete elucidation of the relation of all the possible characters capable of examination, whether physiological or morphological. In the study of a single character it should not be regarded as sufficient to generalise on the results of 100 F_2 plants and a dozen F_3 families. To establish the mode of inheritance of even one character, if it be inherited simply, requires that many hundred F_2 plants should be studied, and as many F_3 families as may be considered necessary to establish the proportions in which occur the three types AA, Aa, and aa. No hypotheses based on F_2 results alone can possibly be accepted as more than tentative.

The dangers of generalising from insufficient data are illustrated from some work of the present writer which has not reached the publishing stage. A cross was made between two plants possessing different types of pattern on the seed coat, A and B. The F_1 was always of type A. In the F_2 the ratio between A and B was not exactly 3:1; there was always a slight excess of type A. Out of 585 plants, 485 were A and 100 were B In families of fifty plants the ratio was often near the 3:1 characteristic of a single genetic difference. A number of F_3 families were grown. Some of the families bred true to A. The B families were composed of B only. Others of the A families segregated into A and B. In the heterozygous families the ratio of A to B was again distorted by an excess of A, and the ratio of A to B was about 4·9 to 1. The proportion of pure to impure dominants, as revealed by their behaviour in F_3, was not 1 to 2. Ten families bred true, and twelve segregated. From this and from other evidence it was concluded that pattern A was due to two factors, each of which could produce the pattern acting alone, and the effect of the two when combined was the same as the effect of either one. Further, the two factors are coupled according to some system not yet worked out. Had the results of the second generation been taken, it might have been supposed that one factor was concerned.

What are the characters necessary to render a plant desirable for genetic investigation? The desirable characters may perhaps be summarized as follows:—

(1) It should consist of a large number of different forms which will cross readily, produce a large quantity of selfed seed, and be easy of culture.

(2) It should not be affected by any destructive fungoid disease, or by any insect pest likely to destroy the plants completely.

(3) It should come to maturity in a reasonably short time, and be capable of culture at any time of year.

(4) It should be a perennial.

(5) It should be capable of being multiplied vegetatively. It is perhaps impossible to discover an ideal plant. One of the most promising seems to be the Castor plant (*Ricinus communis*). Another almost as good is the Pigeon pea (*Cajanus indicus.*)

In working out the inheritance of characters in these two plants it may be suggested that the best method would be to lay out a piece of ground of, say, 5 acres, as a permanent genetic experiment.

There could be, say, a row of 200 of each parent, and a similar number of the F_1. Next could follow, say, ten families of F_2, each consisting of 100 plants. The F_3 families would each consist of, say, 100 plants. The adoption of this method would render possible a very thorough study of inheritance in the plant chosen. The character could be followed through three generations at a time, and if any further evidence were required on any particular point, a fresh culture could be obtained without much trouble.

Perhaps the main idea contained in these notes, upon which it is necessary to lay stress, is that of permanency, and the possibility of repeating work over and over again, if necessary.

When a set of coherent principles applicable to any plant have been established, and when the relations of genetics, cytology, and chemistry have been elucidated, we may be able to tell the practical man how far it is possible to give him what he stands in need of. Of the science of breeding we have as yet barely scratched the surface.

S.C.H

DEPARTMENT NEWS.

Information has been received from Sir Francis Watts, K.C.M.G., the Imperial Commissioner of Agriculture for the West Indies, that he had arrived in New York on his return from Bahamas viâ Florida.

Mr. H. A. Ballou, M.Sc., Entomologist on the staff of the Imperial Department of Agriculture, has left Hong-Kong on his return to the West Indies from Egypt. When he returns, Mr. Ballou will have gone round the world.

COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended May 18, 1918, is as follows:—

ISLANDS. Since our circular report of the 4th instant the market has been very quiet with no demand for the odd bags classing Fine to Fully Fine, of which there are about 700 bales in stock remaining unsold. Although the Factors are showing more disposition to sell, they are unwilling to admit that they would consent to make any marked concession to sell.

During the latter part of this week, there has been some demand for the remaining Planter's crops of Extra Fine, resulting in the sale of them on private terms.

We quote, viz:—

Extra Fine 75c. to 80c. = 77c. to 82c., c.i.f.
Fine to Fully Fine 73c. to 74c. = 75c. to 76c. ,,
Fine to Fully Fine, off in preparation, 70c. to 71c. = 72c. to 73c., c.i.f.
Fine to Fully Fine, stained, 65c. = 67c. c.i.f.

GEORGIAS AND FLORIDAS. During the past fortnight the market has continued very quiet with no demand.

The unsold stock is still held on a basis of Extra Choice 72¼c.

Freight to all New England points is difficult to get, the Ocean Steamship Co. refusing to make any engagements for the present.

The shipments from Savannah for the past two weeks have been either Government cotton or contracts entered into some time since.

In the absence of demand we renew our last quotations, viz:—

Average Extra Choice 72¼c. = 74½c., c.i.f.

The exports from Savannah since May 4, have been, to Northern Mills 1,350 bales, and from Jacksonville to Northern Mills, 839 bales.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and seventy-first meeting of the Council of the British Cotton Growing Association was held at the Offices, 15, Cross Street, Manchester, on Tuesday, May 7.

In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.) Mr. J. B. Tattersall occupied the Chair.

WEST AFRICA. It is estimated that the purchases of cotton in Lagos this season will not amount to more than 5,000 bales; it now appears that the crop is smaller than usual, and the Association's manager reports that an increased quantity of cotton is being used for the local weaving industry, which has been revived on account of the high cost of European manufactured cotton goods.

The purchases of cotton in Lagos to April 30 amounted to 1,654 bales, as compared with 5,480 bales for the same period of last year, 6,648 bales for 1916, and 1,880 bales for 1915.

The purchases of cotton in Northern Nigeria to April 30 amounted to 2,238 bales, as compared with 3,540 bales for the same period of last year, 9,617 bales for 1916, and 282 bales for 1915.

For the time being all shipments from West Africa have been suspended with the exception of ground nuts, palm oil, kernels, and tin ore; an embargo has been placed on the shipment of cotton and cotton seed, but fortunately the Association have had very little to ship for some months; but a quantity of the new crop is now ready, and it is hoped that arrangements may shortly be made for it to be shipped.

The Council are of opinion that the Government should take steps to open up roads in Northern Nigeria, as unless something is done in this direction there will never be any great extension in cotton cultivation.

NYASALAND. A letter from the Director of Agriculture for Nyasaland was read, stating that the returns for native cotton, 1917, have been completed, and the crop amounted to 1,070 tons of seed-cotton (about 2,000 bales) against 944 tons in 1916. This is the second largest crop yet produced by the natives, and there has been the keenest competition for the crop, and no difficulty in selling it to a large number of interested buyers. The Director of Agriculture states that the results are splendid in view of all the work the natives have been called upon to do, and demonstrate the popularity of cotton growing in the districts provided with reasonable transport.

UGANDA. The Association's local manager reports that the crop this season is not likely to amount to more than 50 per cent. of the average crop or, say, 15,000 to 20,000 bales; it had been anticipated that there would be a crop of 40,000 bales, and the result, which is due to unfavourable weather during the planting and growing seasons, is very disappointing. At the same time the prospects of any cotton bought this year in Uganda being shipped from Mombasa are not at all promising, and it may be that the cotton will have to be held in the country for some considerable time.

GENERAL. It was reported that the Annual Meeting of the Textile Institute had been held in Manchester on May 3, and that the Meeting had been addressed by Sir Arthur Steel Maitland, M.P., Head of the Department of Overseas Trade, who made an interesting reference to the Association. As a former Under Secretary of State for the Colonies he bore testimony to the good work which has been done by the British Cotton Growing Association under the Chairmanship of Mr. Hutton, and said that up to the present this is the only instance on the part of British manufacturers in any trade, to combine together to provide supplies of their raw materials.

A LENGTH-SORTING MACHINE FOR COTTON FIBRES.

This machine, to which reference is made in the editorial, has been devised for the measurement of the cotton fibres in ginned lint, in sufficient quantity to eliminate sampling error, and to determine not only the mean maximum length of the sample of fibre, but also the distribution of lengths of all kinds, and to do these operations quickly. A comparatively simple mechanical arrangement, which can be worked up to various degrees of operative complexity for the sake of making the mechanism automatic, has been invented, and a provisional patent has been obtained for it.

Dr. Balls describes this length-sorting machine in the paper already largely drawn upon in the editorial of this

number. He says that it consists primarily of a pair of revolving rollers which, as they revolve, are traversed, or translated bodily along a path at right angles to their axis of rotation. The cotton to be examined is first run through ordinary drafting mechanism, so as to cause the hairs to lie parallel and straight, and this 'sliver' is presented to the rollers at the beginning of a traverse until they have seized a millimetre or so of the front end of the foremost hairs. The sliver is then drawn away, leaving in the nip of the rollers a tuft of hairs which are all held by their front ends.

The rollers continue to revolve, and obviously the first hairs to be delivered from them on the other side will be the shortest hairs, while the longest hairs will be the last to escape, since all started with their front ends level. But since this feeding action of the rollers is combined with, and positively geared to the motion which causes the traverse, it follows that the short hairs will escape on to a suitable collecting device at the beginning of the traverse, the long ones at its completion, and intermediate lengths at intermediate points. Thus the cotton is fractionated by a continuous cycle of operations, repeated as many times as is convenient, not merely into separate parcels of hairs but into a graduated series which may be subdivided to any degree desired.

COTTON CULTIVATION IN BARBADOS.

According to the Barbados *Agricultural Reporter*, June 1, 1918, at a meeting of the Agricultural Society held the day before, a letter from the Acting Colonial Secretary dated May 22 was read, informing the Society that the Acting Governor had received a telegram from the Secretary of State for the Colonies asking that, as far as possible, the acreage of land planted in Sea Island cotton in that island might be increased. The Imperial Government would purchase all the cotton of the next crop, and no quantity could be too large for their requirements. His Excellency had been advised that there was land in the island which would grow good cotton, but poor cane, and that a considerable portion of this land, formerly planted in cotton, had been, owing to the tempting price of sugar, planted in cane. His Excellency would be obliged if the Society could further the interests of the Imperial Government by using their influence as far as possible to induce planters to revert to the cultivation of cotton on such land. The grant of a bounty on cotton cultivation in Barbados had been recommended by His Excellency-in-Executive Committee, and this matter would shortly be brought to the notice of the House of Assembly. As a preliminary step the Government intended to issue posters and leaflets appealing for the increased cultivation of cotton wherever practicable. His Excellency asked the Society to consider the matter at their next meeting.

In regard to this subject, the President of the Society, Sir F. J. Clarke, K.C.M.G., stated that formerly Barbados cotton fetched a price within the range of prices quoted for superfine cotton and not very much below that of St. Vincent cotton. After the Admiralty commandeered the West Indian Sea Island crop a communication was received stating that Barbados cotton would be relegated to a lower grade, and consequently fetch a very much lower price. Under such circumstances, there was no encouragement to cotton growers in Barbados to continue the cultivation of cotton on a large scale.

That there has been a very large decrease in the output of cotton from Barbados during the last four or five years is evident from the official returns of the cotton exported. In 1907-8 the total export of Sea Island cotton from Barbados was given as 988,473 lb. In the year 1915-16 the export had dropped to 132,733 lb., whereas from other cotton-growing islands, notably St. Kitts-Nevis and Montserrat, the average production has been fairly well maintained.

As is pointed out by Dr. Balls in his paper dealt with in this issue with regard to Egyptian cotton, the contamination by natural crossing or by seed mixture of any type of cotton means deterioration in the product. Continual and careful seed selection is imperatively necessary for preserving a type of cotton of superfine grade.

In a letter from Mr. J. W. McConnel published in the *West Indian Bulletin*, Vol. XVI, p. 90, reference is made to the statement of a speaker at the West Indian Cotton Conference to the effect that in the case of Barbados, where there was no elaborate process of selection for purposes of general seed supply, and where yields and types fluctuated considerably, the cotton had yet always commanded a good price; he says, 'I entirely disagree with this statement as showing that seed from mixed types would give satisfactory lint. I do not think the best cotton growers in Barbados would accept this description of their ideals, and so far as it is the practice in Barbados, it may explain the great falling off there has been for many years in its production of cotton.'

INCREASED USE OF 'CUNAS' OR CHINESE GAMBIER.

According to the *Journal of the Royal Society of Arts* for March 8, 1918, there was an increased trade in 'cunas' or Chinese Gambier in South China during 1916; the value of the trade in this product in Hong-Kong alone is nearly 30,000 short tons (of 2,000 lb.) annually. The product is one of great value, and merits the attention of dyers. It has been used by the Chinese for many generations for dye and preservative purposes, and since the disappearance of aniline dyes from the Chinese market as a result of the war, it is coming into still more general use.

The dye is the product of crushing and soaking the root of a plant known by the Chinese as 'cunas', and drawing off and concentrating the liquor therefrom. It is of a brown colour, is highly astringent, works well with various mordants, and is used extensively by the Chinese for dyeing both silk and cotton, a certain class of silk dyed with it being one of the standard cloths of South China. The coarser quality is also the chief component part of a mixture applied to fishing-nets, sails, and similar fabrics to prevent rot. The product seems to have all the merits of gambier, and in general is much cheaper.

It might be worth while to remind readers of the *Agricultural News* of an attempt which was made so far back as 1891 to introduce the Gambier plant (*Uncaria Gambier*) into the West Indies. A description of such introduction was given in this Journal (Vol. II, p. 158), in the form of an abstract from an account by Sir Daniel (then Dr.) Morris, published in the *Kew Bulletin*, 1891, pp 104-9 and reprinted in the *West Indian Bulletin* (Vol. IV, p. 80). Unfortunately the attempt did not prove a success. Plants were sent to Jamaica, British Guiana, Trinidad, St. Vincent, and Dominica. In Trinidad the plants, although they produced flowers, never set seed; in Dominica also no seed was produced; in British Guiana one plant only, which was tried in the forest region of the interior, flourished. Whether further attempts at introduction have been made, and with what measure of success, the writer of this note is not aware.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies — Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor — W. R. Dunlop.*; Rev. C. H. Branch, B.A.

Entomologists — H. A. Ballou, M.Sc.†; J. C. Hutson, B.A., Ph.D.

Mycologist — W. Nowell, D.I.C.

Assistant for Cotton Research — S. C. Harland, B.Sc.††

CLERICAL STAFF.

Chief Clerk — A. G. Howell.

Clerical Assistants — L. A. Corbin.; P. Taylor.*; K. R. C. Foster.

Typist — Miss B. Robinson.

Assistant Typist — Miss W. Ellis.

Assistant for Publications — A. B. Price, Fell. Journ. Inst.

**Seconded for Military Service.*

†*Seconded for Duty in Egypt.*

††*Provided by the Imperial Department of Scientific and Industrial Research.*

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue gives a résumé of a paper by Dr. W. L. Balls on some applications of research to the cotton industry.

Insect Notes, on page 186, contain descriptions of some insect pests in Cuba, and the measures taken to control them.

Some notes on the red rust of cacao are given under Plant Diseases, on page 190.

On page 181 some suggestions will be found for the prosecution of genetic investigation of plants in the tropics.

The 'Station Agronomique de la Guadeloupe'.

This agricultural station which has recently been established in the French island of Guadeloupe in the interests of the sugar industry, is now at work. The establishment is unofficial in its standing, being financed by a syndicate of sugar manufacturers. Mr. J. S. Dash, B.S.A., formerly Assistant Superintendent of Agriculture in Barbados, has been appointed Director. He has his office and laboratory in Pointe-a-Pitre, while the experiment fields of the station are about $2\frac{1}{2}$ miles out of the town. It is intended after the war to erect more suitable permanent official buildings at the station itself.

Under the direction of Mr. Dash the station will doubtless prove of great benefit to the sugar-cane industry in Guadeloupe. It would seem that the most important function of the station will be the raising of seedling canes suitable to local conditions.

Dying Out of Clumps of Sudan Grass.

A case has recently come to notice in regard to the dying out of clumps of Sudan grass, which illustrates a condition liable to occur in the growing of fodder grasses of this type in dry situations.

This condition is essentially the same thing as the so-called root disease of sugar-cane, which is really only the form which failure takes when some condition necessary for growth is deficient. Most commonly it is brought about by shortage of water—which of course is most severe in a shallow soil—or by poorness of soil. In this particular instance, the heavy drain on the vitality of the plants caused by frequent cuttings in dry weather (when even if plenty of manure is supplied there is not enough water to enable the plant to make use of it) is quite enough to account for the trouble. The case of sugar-cane, which is only a grass after all, is similar: in deep soil in well-watered countries it can be grown for twenty years or more without replanting, but in the dry parishes of Barbados for example, it has to be replanted every year to give a good return. The Barbados planter's method with sugar-cane should be copied for Sudan grass, viz., frequent replanting in ground rested by growing a different crop, and heavy manuring. It would also be well, if possible, to trash the ground in dry weather.

Efficient Drainage.

The fundamental necessity of efficient drainage has been long known to agriculturists, as also the fact that efforts to induce fields to yield more abundant crops are largely futile where the land is imperfectly drained.

An article in the *Field*, May 11, 1918, on this subject, very truly states that although improvements in other respects besides draining are necessary to render land fertile, and to maintain it in a highly productive state, it is no exaggeration to say that the first and chief essential is the affording of proper facilities for the escape of superabundant water, not only on the surface, but under it. The harm done by water

lying on the surface is quickly revealed, and as a result, measures are usually taken to provide for its speedy escape from land under crops—a process not entailing great expenditure as a rule. Subterranean drainage is a much more serious and complicated affair, while its influence upon the fertility of the land is correspondingly great and far-reaching. Stagnant water under the surface is as great a hindrance to the growth of plants as water on the surface, and its harmful influence spreads far more widely, neutralizing all other efforts to promote increased fertility, thus giving it an importance much exceeding that attaching to any temporary surface flooding.

False and True Economy in Food.

One of the vitamines that is necessary for the maintenance of health is always found present in certain animal fats. It is found in butter fat and also in the fat of eggs. Consequently it is false economy in arranging a dietary to reduce the consumption of dairy products, for this vitamine though not present in vegetables except in the leaves of certain plants, is obtained in milk and butter. The use of these substances in the human diet is the greatest safeguard to nutritive food. As an article in the *Journal of Agriculture*, Victoria, Australia, March 1918, remarks, the first and safest way to economise in diet is in the consumption of meat. Human beings can do without meat without any detriment to health or strength; they only have to give up the pleasure that is derived from eating meat. Most human beings like meat, and it will probably continue to be an article of human food. Besides, other industries are dependent upon the beef industry; the leather industry for instance. But nevertheless, wherever it is necessary to economise in the dietary, the wise thing to do is to lessen the expenditure on meat while keeping the consumption of butter and milk, using meat chiefly for conferring palatability on vegetables, and in the form of soups and gravies. Especially could this be done with advantage by the inhabitants of the tropics.

New Strain of Cowpea.

The cowpea (*Vigna unguiculata*) and its congener the black-eye pea (*Vigna Catjang*) have been cultivated in the West Indies as green dressings or articles of diet from a very early period. As was pointed out in an article on these peas in the *Agricultural News*, Vol. XIII, p. 370, the imported strains of cowpeas from America have been found to be very susceptible to attacks of insect pests, and it was suggested that work in selection and cross-breeding in these plants might prove of value. We are glad to notice that Mr. S. C. Harland has been experimenting in this direction, and has produced a hardier strain of cowpea, which at the same time is very productive. He proposes that this variety be known as the 'St. Vincent brown-eye' pea. Small parcels of this new pea have been forwarded for trial to the officers in charge of the Experiment Stations in other islands.

The Vanilla Crop in the French West Indies.

The *Perfumery and Essential Oil Record*, April 1918, states, on the authority of the United States of America Consul in Guadeloupe, that the crop of vanilla of that island for 1917, the picking of which commenced in December, is expected to be at least 35 per cent. larger than the output of 1916, which amounted to 73,000 lb. of cured beans. Until November 1 there was every indication that the coming crop would be an especially fine one, but from that time on the dry weather caused many of the beans to drop off, thus spoiling the chances of a record year. The action of the French Government in prohibiting the importation of Mexican vanilla, will probably increase the demand in France for beans from her West Indian colonies. The exports of vanilla from Martinique for 1916 were valued at $3,610, as compared with $7,412 for the previous year. This decrease is stated to have been largely due to inability to obtain transport facilities.

Butter Substitutes in Trinidad.

The *Port-of-Spain Gazette*, April 14, 1918, states that the recipe for making coco-nut butter has met with the greatest appreciation in that colony as well as in the Northern Islands. Coco-nut butter is largely employed for family use, being made regularly in small quantities. Some enterprising firms in Port-of-Spain have begun manufacturing on commercial lines coco-nut butter prepared by some patented method, whereby it can be preserved for months. This article is coming into general use at present in the colony. It is said that scrupulous cleanliness and care are observed in the manufacture. The following certificate by the Acting Government Analyst shows that the local butter substitute is quite up to the mark of any such preparations. The local butter is certified to contain: non-fatty organic matter, 1·00; salt, 3·10; water, 12·85; fat, 83·05. With the large local supply of coco-nuts, Trinidad ought to be independent, at least during the war, of imported butter.

Nutritive Value of Butter Substitutes.

Apropos of the question of butter substitutes, it may be useful to direct attention to the following conclusions drawn from experiments to determine the nutritive value of margarins and butter substitutes with reference to their content of fat-soluble accessory growth substance, published in the *Experiment Station Record*, April 22, 1918:—

'The fat-soluble accessory growth substance is present in beef-fat and "oleo-oil", and is present in margarins prepared upon such a basis. Such margarins are nutritively the equivalent of butter.

'Coco-nut oil, cotton-seed oil, arachis oil, and hydrogenated vegetable oils contain little or none of this accessory substance, hence margarins prepared with a basis of these fats have not an equal nutritive value to that of butter. Nut butters prepared from crushed nuts and vegetable fats are similarly not equal to butter.'

INSECT NOTES.

SOME INSECT PESTS IN CUBA.

In the last number of the *Agricultural News* (No. 420, p. 174) an account was given of the Decree establishing the Commission of Plant Sanitation in Cuba. This Commission was established in 1916 to deal with the important problems in the control of insect pests and plant diseases with which Cuba is confronted at the present time.

It may be of interest to give some notes on the chief insect pests with which the Commission has been concerned since its establishment

THE SPINY CITRUS WHITE FLY (*Aleurocanthus woglumi*).

In the *Agricultural News* for January 13, 1917, there was published an account of this insect, giving its early history, its appearance and spread in a district in the eastern part of Cuba, and the measures taken to control it there up to the end of October 1916. The following notes on the subsequent history of this pest in Cuba up to the end of 1917 are taken from *Bulletin No. 1* of the Commission of Plant Sanitation in Cuba, and from an article by P. Cardin in the *Revista de Agricultura, Comercio y Trabajo*, March 1918. Mr. Cardin is Chief of the Department of Entomology at the Agricultural Experiment Station, and a member of the said Commission.

The spiny white fly was first discovered in Cuba in August 1915 in a small area in the Guantanamo valley, and further inspection showed that there were a number of smaller infestations in the district of Guantanamo, and the city of Guantanamo was found to be thoroughly infested. While species of citrus, mainly oranges and lemons, are the favourite food-plants of this pest, a number of other plants, such as coffee, guava, mango, sapodilla, etc., are also attacked. This white fly is a serious pest of citrus in the neighbouring island of Jamaica, and it is now considered that it gained entrance to the Guantanamo district through the nearest port of Santiago de Cuba, between which port and Jamaica there is frequent communication. From July 1916 to January 1917 the largest infested area was sprayed repeatedly, and the trees were restored to good condition, although not entirely freed from the pest. Owing to the internal troubles which occurred in Cuba during the early months of 1917, the control work against the spiny white fly had to be suspended, and no further report is available.

In November 1916 this insect was found in Havana, and it seems probable that the infestation originated with the introduction of mango plants from Guantanamo some two years previously. Further inspection determined the fact that the spiny white fly was present in several suburbs of Havana, and in some of the smaller towns to the south of the city. Control measures were started immediately and have been carried on subsequently.

Mr. Cardin supplies some details of interest in connexion with the life-cycle of *Aleurocanthus woglumi*. The eggs are laid on the underside of the leaves, and after hatching, the insect passes through three stages before becoming adult. As is the case with other white flies, it is during these intermediate stages between egg and adult that the actual damage is done. In a bad infestation the underside of the leaves is almost completely covered with an incrustation of minute, shiny black, spiny, scale-like insects, while the film of 'black blight', which often accompanies outbreaks of scale insects, white flies and mealybugs, further adds to the blackened appearance of the leaves. A bad infestation causes the leaves to curl up, turn yellow, and eventually fall. The adults have dark bluish-grey wings, and bright reddish orange bodies.

The complete life-cycle, according to Cardin, occupies about sixty-five days, so that there may be five generations a year. The adult females are estimated to lay about forty eggs on an average. This pest is therefore capable of a rapid increase in a comparatively short time.

Among the enemies of the spiny white fly in Cuba are ants; a small spider, in the webs of which large numbers of the adults are caught; and a ladybird beetle (*Chilocorus cacti*). A species of Aschersonia fungus also attacks this pest, and experiments are being made with this fungus. Heavy rains are said to be detrimental to this white fly.

The Commission of Plant Sanitation is making every effort to control this increasingly serious pest by prohibiting the importation of any of the food-plants from other infested countries, by restricting the transportation of plants within the island of Cuba, and by establishing an inspection service in this connexion.

FROGHOPPER (*Monecphora bicincta*).

This insect has been known in Cuba since 1910 as occasionally attacking sugar-cane and certain forage grasses. It came into prominence towards the end of 1916, when it was discovered to have destroyed large areas of grass pasture in the main cattle-raising district of the island. This pasturage consists mainly of the so-called 'Parana' or 'Panama' grass (*Panicum numidianum*), among which Guinea grass (*Panicum maximum*) is sometimes found. Among other species of grass attacked by the froghopper are *Sorghum halepense* and *Andropogon muricatus*. The worst outbreaks of this pest occurred in the midst of fertile pastures where the grass was in a vigorous condition, and the attacks of the froghoppers resulted in the complete drying up of large areas, the grass being either killed outright or so weakened that it was overrun by weeds. The damage is done mainly by the nymphs, or immature stages, which attack the base of the plant and the roots near the collar, gradually sucking the plant dry. The adults also do some damage in this way, but fortunately their period of existence is somewhat shorter.

The following details of the life-history of this pest may be of interest. The eggs were found to be laid on the soil close to the plant in protected places. In the wet season the eggs hatch in from twelve to twenty days, but under dry conditions the eggs may remain unhatched as long as four months until rains come, when they are able to hatch. This pest is found in greatest abundance during the rainy months from July to November. The nymphs moult four times before reaching the adult stage, and in the younger stages are covered with a white froth, hence the name 'spittle insects'. The complete development occupies from thirty-two to forty days, under favourable conditions.

Various methods are suggested for the control of the froghopper in pastures. In the case of bad infestations it is recommended that the dried up areas be burnt over, the fire being controlled by fire-guards. By this means it is hoped to destroy the different stages from egg to adult, though it seems probable that a certain proportion of the adults will escape. It is further suggested that the adults should be collected by the use of trap-lights, but the value of these as a means of control is questionable. The use of a machine somewhat resembling the 'hopperdozer' is also suggested for collecting the adult froghoppers. This apparatus consists of an upright, oblong framework covered with cloth which is smeared with tar or tanglefoot. This machine is dragged across the fields on runners, and catches a number of the

adults which fly up at its approach and are trapped by the sticky material. The rough, uneven nature of many of the Cuban pastures, large areas of which have been in timber, makes the use of a machine of this type somewhat difficult. The employment of the green muscardine fungus, which is present in Cuba, is also suggested as a further remedy against the froghopper.

THE SUGAR-CANE MEALY-BUG (*Pseudococcus sacchari*).

This insect causes serious injury to sugar-cane in some parts of Cuba by attacking both the roots and the stalk. In mild infestations it produces a stunted appearance in the canes, but in certain areas the mealy-bugs occur in such numbers as to kill the canes outright. It is stated that in some places the poor cane is burnt over, the fields ploughed, and new cane is planted, but usually replanted cane fails to grow since the young shoots are killed off by the swarms of mealy-bugs. It was at first thought probable that other factors might have contributed to the death of the canes, and a thorough examination was made.

Termites were abundant in many places among the roots and stubble of the cane, but only in dead parts. A few white grubs were found, but there was no evidence of injury to the roots of the cane by these insects. Fungi were not present in quantity to cause them to be suspected of injuring healthy plants. The soil conditions were found to be as good in the infested areas as in the non-infested. There only remained the mealy-bug to be held responsible for the trouble.

This pest is considered to be the most serious insect problem in relation to sugar-cane in Cuba, and further study is urged in order to determine the exact distribution of this insect, and to discover methods for its control.

J.C.H.

THE ENZYMES OF SOME TROPICAL PLANTS.

A paper on the above subject by Harvey C. Brill, Chief of the Division of Organic Chemistry, Bureau of Science, Manila, appears in *Tropical Life*, April 1918, from which the following is mainly taken.

An interesting part of biological chemistry is the study of enzymes and their properties. Much is known regarding enzymes, but much is still to be discovered with regard to their functions in the growth of the plant, and their effect on digestive processes when taken into the human body along with food.

Some of the foods we are accustomed to eat uncooked contain enzymes of various kinds, and in different quantities. For example, Chittenden has investigated the pine-apple, and studied the proteolytic enzyme present in it. He calls this enzyme bromelin, from the botanic name of the family of plants to which the pine-apple belongs. Bromelin digests egg albumen and blood fibrin. A rennet-like ferment is associated with bromelin. Instead of purchasing pepsin at druggists' shops, which in many cases is worthless, because of faulty preparation, Mr. Brill suggests that it would be more profitable and agreeable to dyspeptics to purchase and consume pine-apples.

Another proteolytic enzyme is papain, which is obtained from the fruit of the papaw. Mr. Brill says that the ripe papaw fruit has all the virtues of the drug sold as papain, and besides is a delicious fruit. It is certain that this opinion is widely held in the West Indies, and it is claimed in these islands that many dyspeptics have been cured, or at any rate very much benefited, by regularly partaking of ripe papaws along with their meals. Papain is considered to be indentical with, or at least to resemble, bromelin very closely.

The banana has recently been thoroughly investigated for enzymes. This fruit is rich in ferments, giving evidence of the presence of enzymes which influence the digestion of starch, sugar, proteins, and fats. Thus banana eaten along with breakfast aids the digestion of all the materials which generally compose that meal.

The mango also contains a proteolytic enzyme which has properties similar to those of bromelin.

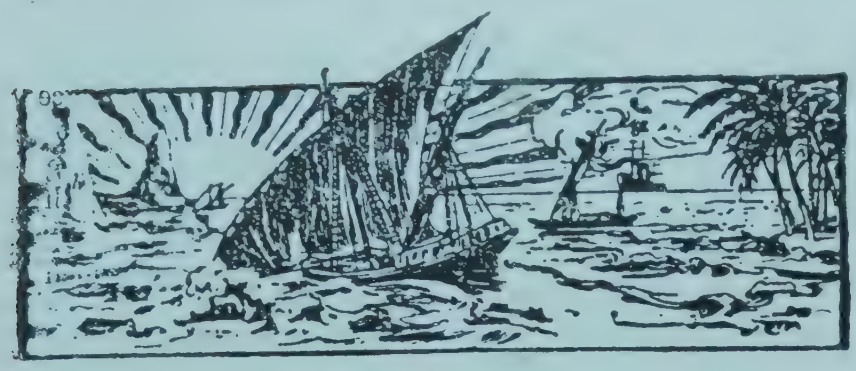
It would thus appear that these four prominent fruits of the tropics, the pine-apple, papaw, banana, and mango have a positive food value other than that of nutrition, in that they aid in the digestion of other foods.

The simple synthetic food tablet which was to carry the necessary food elements—protein, fat, and carbohydrates—in the relative proportions demanded by the human body for its growth, development, and performance of its daily duty, must now be relegated to the dreams of pseudo-science. The process of assimilating food is a much more complex one than was once believed, and the perfect food of the future will hardly be prepared in tablet form.

A BERRY POISONOUS TO FOWLS.

The order of plants, *Solanaceae*, to which the potato belongs, contains species possessing very different qualities. Some are extremely poisonous, and others, as are well known, are among the most nutritious of vegetables. These differing properties occur in different species even of the same genus, as is the case in the genus Solanum. The berries for instance of *Solanum melongena*, known as the egg plant or Melongène, are a wholesome article of food. The berries of other well-known West Indian species, such as those of the bitter berry or canker berry (*Solanum igneum*), although distinctly bitter in flavour, are, as far as the writer of this note knows, perfectly innocuous, and are quite freely eaten by children in the West Indies without any deleterious effects. There are, however, some species of this genus the berries of which are very poisonous. Among these is *Solanum seaforthianum*. This is a South American species, cultivated as a climber in West Indian gardens, and is one of the lighter varieties of climbing plants, with deeply lobed leaves as much as 6 inches in length, and produces graceful racemes of light blue flowers, the expanded petals of which measure about $\frac{3}{4}$-inch across, with a centre of bright yellow coherent anthers, making a very pretty contrast. These flowers are succeeded by bunches of berries which turn a brilliant red when ripe, each about $\frac{1}{2}$-inch in diameter, and containing many seeds, which are covered with a dense mass of hairs.

In the West Indies these berries have always been considered poisonous, and children are warned against them. It appears however that these berries have proved to be very poisonous to fowls in Queensland, where also the plant has been introduced for ornamental purposes. In the *Australian Sugar Journal*, March 7, 1918, it is stated that Mr. Henry Tryon, Government Entomologist and Vegetable Pathloogist, has been investigating cases of poisoning amongst fowls which he attributes to the berries of this plant. These are consumed, it is stated, with avidity by fowls. Under these circumstances, it will be well for poultry keepers to be aware of growing this plant in situations where their fowls can obtain access to the berries. It is not stated whether the berries, which fall only after they are almost quite dry, still retain in their dry condition this poisonous property. Caution, however should be used in allowing poultry to eat the berries even when dry on the ground.



GLEANINGS.

According to the London *Daily Express*, April 30, 1918, Jamaica pine-apples had not reached the English market for eighteen months, but a large consignment had just arrived, with a quantity of Canary bananas and grape fruit.

It is stated that molasses made from pine stumps, and called 'pintose' has been exhibited in New Orleans. This pine molasses is described as well adapted for use as a filler in stock feeds. It looks like poor cane blackstrap molasses, but has not the same feeding value, and, by itself, is indigestible. (The *Louisiana Planter*, May 18, 1918.)

From an experiment conducted in Mysore, it would seem that prickly pear might be profitably used for paper pulp if the spines and massive flesh could be removed by some cheap and easy method. The remaining fibres produced pulp suitable for paper, when mixed with longer-fibred pulp of some other raw material. (The *Wealth of India*, February 1918.)

One of the most notable war developments of Indian agriculture has been the revival of the natural indigo industry. With the cessation of supplies of synthetic indigo from Germany, the area under indigo increased from 148,400 acres in 1914-15 to 756,400 acres in 1916-17. Every effort is being made to give the present revival of the natural dye a permanent character. (The *Field*, May 4, 1918.)

A greater production of manioc, yams, sweet potatoes, and other tubers is this year assured in Ceylon. An effort to encourage the cultivation of these crops in the principal rubber-growing areas has been made. In one section an increase of over 100 acres is recorded, and this is mainly under yam crops and vegetables. (The *Tropical Agriculturist*, March 1918.)

The advantages of using goats' milk are: (1) that the goat eats about one-sixth of the quantity of food required by a milch cow; (2) that for nine or ten months it yields 3 to 5 litres of milk which can be safely taken uncooked; because (3) goats are very seldom affected by tuberculosis; and (4) that the fat in the milk, being in very fine emulsion, is easily digested. (The *Wealth of India*, February 1918.)

More than one independent line of argument will be found to point to the conclusion that in a period of 2,000 years there has been no appreciable change of climate in the world. Therefore the balance of the heat exchanges between the earth's income from the solar radiation, and its expenditure in terrestrial radiation into space, may be regarded as only fluctuating between narrow limits. (*Nature*, May 2, 1918.)

The *International Sugar Journal*, April 1918, states that according to *Facts About Sugar*, the Santo Domingo sugar crop will be fully up to expectations, 200,000 tons of cane being the estimate. A new central, La Romana, is being erected to grind 2,000 tons of cane per twenty-four hours, with provision for expansion to 4,000 tons.

According to the *Louisiana Planter*, May 18, 1918, operations with the Luce cane harvester in the fields of Central Mercedes in Cuba have been very satisfactory. The harvester, operating in short rows of 400 feet, in cane averaging 20 tons per acre, harvests a little over 11 tons an hour. In longer rows it could do much better than this. On account of the necessity of turning the machine round at the end of a 400-foot row, work is necessarily slower than it would be in longer rows.

Development of the honey industry in the West Indies, in the interests of the English food supply, is under the consideration of the West India Committee. Some of the finest honey in the world comes from Jamaica, which exports to England some 500 tons a year. But the other British West Indies produce little honey, though well suited for it. It is suggested that at least half a million bee hives might be put down this year between the Bahamas and Trinidad, and an increase of production by 5,000 to 10,000 tons. (The *Yorkshire Post*, April 27, 1918.)

The protection and preservation of insect-eating birds is a matter of urgent necessity. Difference of opinion exists as to the economic status of a few species, but all who have studied economic ornithology and entomology are agreed: (1) that the great majority of wild birds are beneficial to man; (2) that insect-eating and vermin-eating species in particular are invaluable to him in field and garden; (3) that children should not be permitted to take part in the destruction of birds and eggs, even of species deemed injurious, since useful ones inevitably suffer also. (The *Field*, May 4, 1918.)

The *Tropical Agriculturist*, March 1918, refers to experiments made in Ceylon on the preservation of coco-nuts by storing them under different conditions. These experiments showed that nuts in the husk, stored in the open, lost their water in nine months, and all germinated between the seventh and ninth month. Nuts, however, stored under shade in a dry place, lost their water in six months, and were all sound at the end of twelve months. It is pointed out that in storing nuts care must be taken that no heating takes place by over-heaping, and that the husks should be perfectly dry before storing.

Professor William Bateson, in opening the meeting of the Royal Society of Arts, April 10, 1918, said in the course of his speech that anyone who knew something of genetic science and its possibilities would feel amazed at the practices which prevailed on rubber plantations in the Malay Peninsula. He was quite sure that the application of trained intelligence for a few years would work a revolution. Good, bad, and indifferent plants were being cultivated; all sorts were grown together, occupying equal space and attention. In a reasonable time it ought to be possible to produce a pure strain of the best trees only. The same thing also applied to coco-nuts. (The *Journal of the Royal Society of Arts*, May 3, 1918.)

TORTOLA: REPORTS ON THE AGRICULTURAL DEPARTMENT, 1915-16 AND 1916-17.

The reports on the Agricultural Department of the Virgin Islands, for the years 1915-16 and 1916-17 have just been issued together. It appears that the publication of the former was delayed through unavoidable circumstances, hence the publication of the two reports together.

In the report for 1915-16 we notice that the Curator, Mr. Fishlock, thinks that the Governor plum, of which there is a hedge at the Botanic Station, Tortola, ought to be named *Flacourtia sepiaria* and not *F. Ramontchi*, on the ground that the latter grows to a small tree, whereas the former is a shrub. This is quite true, but nevertheless, as was stated in a note in the *Agricultural News*, Vol. XIV, p. 339, the species fairly well spread throughout the West Indies, and successfully grown as a hedge not only in Tortola, but in St. Lucia and Dominica as well, is *F. Ramontchi*, which like other small trees, lignum vitae for instance, forms a capital hedge, if kept well trimmed. As far as we know, there is only one specimen of *F. sepiaria* in the smaller islands, and that is in the Botanic Garden, Dominica. This is a slow growing shrub with small, oval berries, quite distinct from the fairly large, round berries of *F. Ramontchi*.

The tone of the two reports is markedly different. That of the first is hopeful; of the second, one can only say that it is but slightly removed from despondency. Nor is this to be wondered at, when it is remembered that the Virgin Islands, especially Tortola, experienced the full violence of a destructive hurricane in October 1916, which greatly damaged all the crops of the Presidency. We can only hope that the energetic efforts which were evidently made to repair the damage caused by the hurricane have met with success in the year just passed.

The establishment in 1915 of a Cotton Seed Farm, mainly for the purpose of producing seed of dependable quality, and of a pure strain suitable to local conditions, is a step in the right direction. Hitherto all the Sea Island cotton grown in the Vigin Islands has been from seed obtained from St. Kitts and St. Vincent. But experience in other islands has shown that each island tends to produce its own strain of cotton, which it is advantageous to develop and keep pure. It is to be hoped that good results will accrue to the Virgin Islands from this undertaking. For it must be noted that the production of cotton, to which the conditions of those islands seem eminently suited, has much declined there. In 1912, the year of the greatest production, 52,677 lb. of cotton lint were shipped, of the value of £3,165, but this fell year by year, until 1916 when only 15,253 lb. were shipped, valued at £1,465. It is to be regretted that the cotton flower-bud maggot (*Contarinia gossypii*) has made its appearance in Tortola. This pest seems to have been successfully dealt with in Antigua, where it was troublesome some years ago. Early planting was advised by Mr. Ballou the Entomologist of this Department, and it may be practicable to adopt this means of avoiding attack should the effects become serious in Tortola.

The lime industry, on which some hopes had been based has been practically put an end to by the hurricane of 1916. Such large numbers of trees were destroyed that it will be some years before the lime plantations can be re-established, should that course be considered advisable. As the result of manurial experiments with lime trees, Mr. Fishlock advises liberal surface mulching with sparing applications of nitrogenous manures.

The important food crop of sweet potatoes has been the subject of experiments with a large number of varieties, carried on for some years.

It would seem as if a profitable market for onions grown in the British Virgin Islands can be found in the neighbouring Virgin Islands of the United States, and that this industry might be profitably extended in the future.

Experiment plots planted in other foodstuffs—Indian corn, cassava, beans, and peas—were yielding interesting results, but were practically destroyed by the hurricane.

A crop which Mr. Fishlock thinks deserving of more attention, is coffee. He considers that it could be successfully grown in many parts of Tortola, and that a sufficient quantity could be produced to meet local demands.

In spite of the immense damage done by the hurricane of 1916, the reports show that progress in agricultural matters is being made in the Virgin Islands, and that the Agricultural Officers in charge of the Experiment Station in Tortola are to be congratulated on the results of their work.

EXPLANATION OF SOME MENDELIAN TERMS.

As certain technical terms are often being used in articles in this Journal relating to plant breeding, it will be useful for general readers to have a short explanation of some of them.

Except for relatively rare instances, a new individual, whether plant or animal, arises as the joint product of two sexual cells derived from individuals of different sexes. Such sexual cells, whether ova or spermatozoa or derived from ovules or pollen grains, are known by the general term of *gametes*, or marrying cells, and the individual formed by the fusion or yoking together of two gametes is spoken of as a *zygote*. Since a zygote arises from the fusion of two separate gametes, the individual so formed must be regarded throughout its life as a compound structure, in which the components brought in by each of the gametes remain intimately yoked in the form of partnership.

The various generations are denoted by the signs F_1, F_2, etc. In this system F_1 denotes the first filial generation, F_2 the second filial generation produced by two parents belonging to the F_1 generation, and so on. When in the F_1 generation a character which is peculiar to one of the parents appears in each individual, that character is denoted the *dominant*. In the same way a character possessed by one of the parents, which disappears from view in the F_1 generation, is denoted *recessive*.

To express the constitution of individuals in respect of inherited characters, the words *homozygote* and *heterozygote* are employed. An individual is said to be homozygous for any character when it is derived from gametes both of which possess that character. When however the zygote is formed by two gametes, of which one bears the given character while the other does not, it is said to be heterozygous for the character in question, and only half the gametes produced by such a heterozygote bear the character.

PLANT DISEASES.

ALGAL DISEASE (RED RUST) OF CACAO.

In the annual return regarding the prevalence of pests and diseases in St. Lucia in 1917, Mr. A. J. Brooks, Agricultural Superintendent, reports that algal disease of cacao occurs on most estates at certain periods. Although specimens were collected as early as 1902 by Mr. G. Whitfield Smith in Grenada, the disease has previously attracted little or no attention from cacao growers in Grenada, St. Lucia, or Dominica. Its occurrence in Trinidad was made the subject of a paper by Mr. J. B. Rorer in the *Proceedings of the Agricultural Society*, Vol. XVII.

The algal organism responsible is best known and has been closely studied as the cause of a troublesome affection of tea twigs in India and Java, known as red rust. The alga is widely distributed and common in the tropics, especially on the leaves of numerous trees. That it can resist severe conditions is illustrated by its presence on avocado pear leaves in all but the most exposed situations in Barbados.

The twigs of cacao are occasionally attacked, and die-back due to this cause is reported to be not uncommon in Trinidad, and is recorded from Jamaica. The organism occurs in fairly extensive patches on twigs and small branches of limes in some localities, forming at the same time spots on the leaves which are blackish or rusty red according to the stage of development. It occurs also on mango both in India and the West Indies.

CAUSATIVE ORGANISM. *Cephaleuros virescens*, Kunze, (*C. mycoidea*, Karst., *Mycoidea parasitica*, Cunn.). The causative organism is one of a group of mostly epiphytic algae, and affords an instance of partial parasitism which outside this genus is exceedingly rare in the algae. The organism is very common on leaves, especially those with a smooth surface and somewhat leathery texture.

In this type of situation it forms, generally on the upper surface, orange or rusty red, roundish or less often irregular, slightly raised patches up to nearly $\frac{1}{2}$-inch in diameter. As a rule the presence of the alga on leaves causes little or no damage. In the case of tea, cacao, limes, and mango alike, it is in its occurrence on the twigs that destructive powers may be developed.

The first outward sign of the disease on cacao shoots is the occurrence during the dry season, on the twigs of the previous season's growth, of dark purplish or black spots ranging up to $\frac{1}{2}$ or $\frac{3}{4}$-inch in diameter. With the coming of the rains these take on a rusty-red colour due to the development of a dense pile of fine hairs bearing tiny globular heads, the sporangia of the alga. The latter when ripe discharge when wetted numerous biciliate zoospores, which after a short active period come to rest, and are capable of germination. The ripe sporangia are capable of being broken off and transported by wind before this discharge occurs.

A second type of sporangium, essentially similar, is formed in the body of the thallus as it occurs on the surface of leaves.

The alga is itself liable to be invaded by fungus hyphae, producing for a time a type of structure resembling that of a lichen.

NATURE OF THE ATTACK. On various leaves the alga exists in all conditions between the common case of mere attachment to the cuticle and complete penetration leading to the development of thalli (cellular expansions) on both sides of the leaf. The epidermal ce ls beneath an algal patch are usually, but not invariably, discoloured and dead. The only importance attributed to the occurrence of the organism on leaves lies in the provision of material which can infect the stems.

Infection of the twigs appears to take place from germination of the zoospores in the surface cracks which develop in connexion with the formation of the first layers of bark. The alga pushes in among the cortical tissues, successive layers of which are sloughed away. The irritation caused by the presence of the parasite sometimes results in hypertrophy (abnormal swelling) of the twigs. In severe cases the separate patches first occurring on the twig may coalesce and competely envelop it for some distance.

If growth is not sufficiently vigorous to throw off the infection by new and deeper bark formation, the result is the failure of the leaves and the death of the twig, and short of this effect, the lesions in the bark are liable to afford access to the die-back fungus (Diplodia).

INFLUENCE OF EXTERNAL CONDITIONS. The accounts of the diseases caused by this organism agree as to the dependence of serious injury on lack of vigour in the host. On tea the disease occurs suddenly and constantly whenever bushes become unhealthy from any cause whatever. On cacao most harm has been observed where the trees were in poor condition as a result of exposure or insufficient drainage.

The reasons for this are believed to lie in the inability of weakly twigs, as indicated above, to get rid of the parasite, and in the greater susceptibility to infection of twigs in which bark formation is weak and slow. It has been observed that at the other extreme, the very quick-growing shoots produced on tea after severe pruning develop cracks in the bark which are liable to infection.

CONTROL. Spraying with Bordeaux mixture has proved ineffective against the disease, and no direct method of control is known. The appropriate remedy, adopted with great success in the case of tea, lies in close attention to drainage, cultivation, and manuring.

W.N.

IMITATION COFFEES.

The agreeable and stimulating qualities of coffee as a beverage have given it world-wide importance, and this has led to the employment of a number of substances known as coffee substitutes. An interesting account of some of these appears in the *Wealth of India* for February 1918. It is pointed out that, properly speaking, these substitutes should rather be called imitation coffees, since they do not contain all the qualities which give to coffee its peculiar individuality.

Coffee contains three essential principles: caffeone, an aromatic principle developed during roasting; a bitter principle possessing febrifugal properties; and caffein, a stimulant. Many nervous persons are obliged to forego coffee as a drink, even though they may be fond of it, on account of the presence of caffein. In recent years decaffeined coffees have been put on the market, which have been deprived by chemical treatment of the stimulating effect of the caffein, still retaining the aroma of the caffeone.

The imitation coffees do not possess all the properties of coffee, and only vaguely suggest its flavour. They are either mixed with coffee or used alone; they all contain a bitter

principle, and impart a brownish yellow colour to water. One of the most largely used coffee substitutes is the roasted and ground root of chicory (*Cichorium intybus*), which was largely produced before the war in Belgium and the north of France. Some persons use a mixture of coffee and chicory as a matter of taste, but still more probably use it involuntarily in some of the ground coffee sold in packages.

Another widely used coffee substitute is barley malt, which when roasted has a pronounced aroma resembling coffee, hence its extensive use as a non-stimulating tonic, and digestive beverage. The non-germinated grains of barley, oats, wheat, rye, and maize, roasted over a slow fire, and then ground in a mill, are also frequently mixed with coffee.

The seeds of three European leguminous plants are used in some parts of Europe as coffee substitutes: they are the narrow-leaved lupine (*Lupinus angustifolius*); the chick pea (*Cicer arietinum*); and the Spanish astragalus (*Astragalus baeticus*). The seeds of these plants are roasted and ground, and the infusion made from the resulting powder, is said not to be unpleasant.

The long pods of the carob or locust tree (*Ceratonia siliqua*) reduced to a pulp, and subjected to a roasting process, form the basis of an imitation coffee largely consumed by the natives of Algeria.

About fifty years ago the use of fig coffee began in Austria-Hungary. Thence it spread to Germany and the Balkan States. It has been used in France for the last ten years, especially during the war, and is found in stock in many groceries there. The success of fig coffee in France is a result of the war, many persons having substituted the roasted figs for chicory, which has become scarce owing to the occupation of Belgium and Northern France by the enemy. Fig coffee is said to resemble the real article amazingly. Used alone, it yields a sweet infusion of agreeable flavour. Mixed with coffee in the proportion of one-third, it colours the infusion deeply, and modifies its bitterness: it sweetens and makes it nutritious. The use of fig coffee makes it possible to give children a nutritious cup of *café au lait*, the taste of which pleases them, and which contains no unwholesome substance.

There is a saying in Austria that there is no good coffee without figs. Although this may be going somewhat too far, it may be affirmed that the numerous good qualities of fig coffee place it in the first rank of this group of products which consists of what we have designated as imitation coffees. It possesses one drawback, however, in the fact that unless kept in tightly closed receptacles it quickly deteriorates, as it so easily absorbs atmospheric moisture.

The okra (*Abelmoschus esculentus*), well known in the West Indies, is said to form an excellent imitation coffee. The dry seeds are carefully roasted, and when cooled are ground. The infusion suggests coffee, but with a special flavour which is agreeable to many people.

Another West Indian plant which grows, in the tropics of both the East and the West, is the small shrub, *Cassia occidentalis*. Its seeds, roasted and crushed, furnish the so-called black coffee of Senegal. They are also used for the same purpose by the labourers in several of the West Indian islands. The aroma of the infusion recalls that of coffee, but it possesses no stimulating properties.

Lastly, according to *Revue Agricole de l'Ile de la Réunion*, December 1917, it has been discovered that the seeds of the widespread wild tamarind (*Lucaena glauca*), roasted and ground, yield a reddish brown powder having the colour and the smell of coffee, the infusion of which possesses an even stronger aroma than genuine coffee itself.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of April 1918:—

The general tone of the Produce Markets during the month of April has shown little or no change since that of March, either in bulk of produce brought forward, the quantities that have changed hands, or in prices demanded or obtained. The intervention of the Easter holidays also has had an adverse effect on business generally. The following are the principal details affecting West Indian products.

GINGER.

At the first auction on April 3, ginger was in good supply: 1,164 bags were offered and disposed of, washed rough Cochin fetching from 90*s.* to 91*s.*, and fair to good rough Calicut 86*s.* to 88*s.* A fortnight later the offerings were 30 cases of small cut Cochin, and 133 bags of limed Japanese. The former were all bought in at 120*s.* per cwt., and the latter at 85*s.* At auction on the 3rd of the month some 40 odd cases of Bombay mace were offered; ordinary dull to fair reddish fetched 3*s.* 2*d.* to 3*s.* 6*d.* per lb., being an advance of from 1*d.* to 2*d.* per lb. on previous rates. These advanced rates were maintained a fortnight later when some 68 packages of West Indian were disposed of. Nutmegs also have been in good demand; some 150 packages of West Indian found buyers at auction on the 18th of the month at an advance of from 2*d.* to 3*d.* per lb. on previous rates. There has been a steady demand for Pimento throughout the month at from $5\frac{1}{4}d.$ to $5\frac{1}{2}d.$ per lb.

SARSAPARILLA.

At auction on the 11th of the month the offerings of sarsaparilla were as follows: grey Jamaica, 19 bales; native Jamaica, 13 bales; and Honduras, 3 bales. All the grey Jamaica was disposed of at 4*s.* 3*d.* per lb., consisting of a mixture of fair grey, and some partly mouldy and rough. The whole of the native Jamaica also found buyers at from 3*s.* 4*d.* to 2*s.* 11*d.* per lb. for good red, yellow, and red mixed, and common grey and yellow. The 3 bales of Honduras remained unsold.

CITRIC ACID, KOLA, ARROWROOT, AND CASSIA FISTULA.

In the early part of the month citric acid was steady at 3*s.* 2*d.* per lb., but later it advanced to 3*s.* 3*d.*, at which price it stood at the close. Kola has been in good supply as well as in good demand. At auction on the 11th of the month 75 packages of West Indian were offered, and 74 disposed of at rates from 10*d.* to $11\frac{1}{2}d.$ per lb. for good bright halves and whole nuts. For good manufacturing St. Vincent arrowroot 1*s.* 4*d.* per lb. has been asked throughout the month. Cassia Fistula is at the time of writing reported to be so scarce that one holder has been asking as much as £5 for a small and indefinite quantity.

During November 1917, to which the latest returns refer, there were actually being worked 146 oil wells of the 365 which have been sunk in Trinidad, and the quantity of crude oil produced amounted to upward of 4,500,000 Imperial gallons. (The *Journal of the Royal Society of Arts*, April 19, 1918.)

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, May 2.

ARROWROOT—No quotations.
BALATA—Venezuelan Block, 3/4½; Sheet, 3/11 to 4/2.
BEESWAX—No quotations.
CACAO—Trinidad, 90 -; Grenada, 85/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 2/6 to 3/3.; concentrated, no quotations; Otto of lime (hand-pressed), 16/6.
LOGWOOD—No quotations.
MACE—2/5 to 3/6.
NUTMEGS—1/10 to 2/4.
PIMENTO—No quotations.
RUBBER—Para, fine hard, 2/1½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., May 27.

CACAO—Venezuelan, $11·50 to $11·75; Trinidad, $11·25 to $11·75.
COCO-NUT OIL—$1·51 per gallon.
COFFEE—Venezuelan, 12c. to 13c. per ℔.
COPRA—$6·80 per 100 ℔.
DHAL—$13·75 to $14·00.
ONIONS—$3·25 per 100 ℔.
PEAS, SPLIT—$11·00 per bag.
POTATOES—English, $3·00 per 100 ℔.
RICE—Yellow, $13·75 to $14·00; White, 9·50 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS. & Co., May 17.

CACAO—Caracas, 12⅝c. to 13¼c.; Grenada, 13¼c. to 13½c.; Trinidad, 13½c. to 13¾c. Jamaica, 12c.
COCO-NUTS—Jamaica selects, $40·00; Trinidad selects, $38·00; culls, $19·00 to $20·00 per M.
COFFEE—Jamaica, 9¼c. to 10½c. per ℔.
GINGER—15½c. to 19c. per ℔.
GOAT SKINS—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per ℔.
GRAPE FRUIT—Jamaica, $2·50 to $4·00 per box.
LIMES—Import prohibited.
MACE—38c. to 47c. per ℔.
NUTMEGS—29c.
ORANGES—Import prohibited.
PIMENTO—7c. to 7¼c. per ℔.
SUGAR—Centrifugals, 96°, 6·005c; Muscovados, 89°, 5·005c. Molasses, 89°, 4·948c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., May 30.

ARROWROOT—$12·00 per 100 ℔.
CACAO—$12·50 to $13·00 per 100 ℔.
COCO-NUTS—$36·00 husked nuts.
HAY—$2·90.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
SUGAR—Dark Crystals, $4·75.

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A FORTNIGHTLY REVIEW

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Progress in Plant Breeding.

THE fact that plants, like animals, are capable of being improved by careful breeding, has only been thoroughly recognized during the last century. Only a few scientific horticulturists at the beginning of the nineteenth century had begun to realize the importance of this process in agricultural matters. During the century, chiefly owing to the promulgation in the latter part of it of Mendel's researches, the knowledge of the factors involved in plant breeding has gradually increased, and been widely disseminated. Recent developments in this direction have forcibly called attention to the great improvements which skill and patience under scientific control may achieve in this field, and it may be said that interest in plant breeding has been stimulated enormously in the last few years.

With regard to West Indian agriculture and horticulture, it must be remembered that almost all the plants cultivated throughout these islands, either in the field or in the garden, with very few exceptions, have been introduced from other parts of the world. In the early days of colonization each expedition brought seeds and plants to use in starting agricultural industries; and subsequent importations of new varieties continued to be made. The early settlers probably practised a system of what might be almost called automatic selection in growing these plants, and in testing experimentally the possibility of their succeeding under the different conditions under which they were being grown. This selection, which must certainly have been exercised to a greater or less extent throughout the history of these islands, probably did not have any definite improvement or change in view other than to secure the best and most vigorous seed.

To-day, however, the careful and complex methods of modern plant breeding and selection have placed a different aspect upon the introduction of new varieties. These are still being introduced, but chiefly for a different purpose. Not entirely with the idea that they may become commercially important themselves are such introductions now made, but that select seedlings from them, and hybrids between them and

already existing varieties may be obtained, and through these, strains possessing qualities locally desirable may be produced.

In the last century, it seems that the systematic breeding of plants may be said to have begun with the work of Knight and Van Mons about the beginning of the century. Thomas Andrew Knight, an eminent English plant physiologist, may be called the father of plant breeding, since he was the first to show, in 1806, the practical value of hybridization in the production of plant varieties. Of almost equal importance, however, was the work of a contemporaneous Belgian horticulturist, Jean Baptiste Van Mons, who emphasized mainly the principle of selection. It will thus be seen that the fundamental laws of plant breeding were fairly well understood at the beginning of the century, and had been published in horticultural text-books and papers. It requires long years, however, for scientific principles to become thoroughly recognized and widely disseminated. This result, as was noticed before, has largely been due to the universal acceptance of the laws of heredity expounded by Mendel, as a result of his classical experiments on the common pea.

During the first fifty years of the century almost the sole method of breeding, both in Europe and America, was to select seeds from the best types of plants, and to raise numerous seedlings, of which those were selected for further propagation which seemed to be of better quality than the parent. For instance, when a particularly good fruit was produced, its seeds were carefully preserved and planted, and some varieties in the main true to type were reproduced, but only a few superior or new varieties resulted. Hybridization and cross-fertilization in improving plants were very little utilized until during the last half of the century.

Since the middle of the century additions to the knowledge of the laws of inheritance have caused a great advance in methods of improving plants. One important factor in the application of hybridization to producing improved strains is the securing of what have been termed 'dilute hybrids', that is hybrids containing more constituents of one of the parent varieties than of the other. If in any hybrid the characters of one of the parents are found to be too pronounced to give a successful combination, that hybrid may be crossed back with the other parent, and the process repeated until the desired combination is obtained.

The prime importance of growing hybrids through several generations in order to fix the characteristics aimed at has only been recently recognized as a necessary deduction from Mendelian laws.

The production of varieties which have been obtained by careful methods of selection carried through from one to many generations has always had a marked effect on the development of certain agricultural industries, notably that of cotton. Scientific hybridization has also had a very marked effect in the development of many cultivated plants, and in the future there is no doubt that it will be more and more extensively utilized in securing and perpetuating desired modifications in probably every crop economically valuable.

A striking instance of the wonderful amelioration that can be accomplished by careful breeding in a plant is the tomato. According to an article in the *Yearbook* of the United States Department of Agriculture, 1899, in the early part of the century the races of tomatoes produced mostly small and lobed fruits. Dr. Hand, of Maryland, began his work in connexion with it in 1850. He crossed the smooth tomato, which was filled with juice and seeds, with the compound convoluted tomato generally cultivated at that time. By selection and further hybridization he produced a race of large, smooth, round tomatoes with solid contents, and the improvement of this fruit has been continuing ever since.

Another striking instance of the improvement in a plant by selection and hybridization is the maize, very many of the best races of which have originated as carefully produced hybrids, and have been improved and fixed as to characteristics by further long-continued selection.

The selection that is regularly practised by all intelligent growers, and which to-day may be regarded as one of the necessary cultural methods in the production of cotton, especially Sea Island cotton, has resulted in the increase of length and fineness of fibre, until in places where such selection is rigidly employed the cotton has reached a very high standard in respect of the characters regarded as most desirable.

Probably in no plants, however, has hybridization given such marked results as in those cultivated for their flowers. This is due largely to the fact that in such plants variations of form and colour are the greatest desiderata, and such modifications are found to be easily obtained by hybridizing different coloured species or varieties.

It may be observed that the tendency to get rid of existing varieties of commercial plants in favour of

some new, apparently more desirable strains, is not without its danger. In the West Indies, for instance, Mr. S. C. Harland states that recently in St. Vincent a survey made of the forms belonging to the common French bean (*Phaseolus vulgaris*) showed that, in respect of seed colour alone, twelve varieties existed in that island, and it is certain that the number of kinds differing in other characters must be many more. The biological composition of no one species of cultivated plant has yet been thoroughly investigated in the West Indies, and it is highly desirable that a survey of native material should be instituted in the interests of plant breeding.

The experience of European plant breeders tends to show that old races of economic plants should not be allowed to become extinct. Dr. Nilsson-Ehle, the celebrated Swedish plant biologist, says, as quoted by Mr. L. H. Newman in his book *Plant Breeding in Scandinavia*, that 'even if the new sorts actually are superior to the old sorts, and deserve to be spread, it may be insisted that by displacing the old so-called native sorts there may be a danger of losing for all time many valuable constituents which they may possess, and which might become of value in breeding work.' Mr. Newman goes on to say that this would seem to indicate the advisability of a breeding station adopting some definite plan whereby representative cultures of the best old races may be retained, in order that a perennial source of new selection and material for continued crossing work may thus be provided. Mr. Harland suggests that much could be done by the existing Botanic Stations in these islands, in making and preserving collections of this kind.

In connexion with the advocacy of the growing of pure strains of cotton referred to in the editorial of our last issue, it was pointed out by Mr. W. Nowell at the West Indian Cotton Conference held in St. Kitts in 1916, that 'there were dangers in restricting seed selection to narrow limits. At the present time there were good many different strains exhibiting great similarity, but still possessing differentiating characteristics. If a strain was selected which had certain of these particular characters, and this were exclusively grown, some characters possessed by other strains would be lost. Provided the lint was satisfactory, mixed types were safer, because more capable of adjusting themselves to their environment, including diseases which might at any time occur. Moreover, should the circumstances of the market so change that the type which had been put into cultivation was no longer the most desirable, and it became necessary to recover the characters lost in the other strains, the planter would be limited and narrowed down to selection from that one type for which the demand had declined.'

Examination by Mr. S. C. Harland, the Assistant for Cotton Research, attached to the Imperial Department of Agriculture, conducted on a broader basis than that from which the original selection was made, of certain approximately pure strains already in cultivation, has shown that certain characters of value have actually been bred out in securing others regarded as of primary importance.

It would seem, therefore, that Mr. Harland's suggestion of collecting and preserving various strains of cotton in special plots of the Botanic Stations in the islands where that crop is cultivated, would be highly advantageous, and would at the same time in no way interfere with careful selection in planting the type at present found most desirable.

USE OF PRICKLY PEAR SAP IN ARSENICAL SPRAYS.

A note in the *Journal d' Agriculture Tropicale*, April 1918, draws attention to the value of the sap of the prickly pear in preparing arsenical sprays. It is of importance to impart to these sprays the greatest possible adhesive power, not only that they may exercise their effect as long as possible, but also that the least possible quantities of them may be used to obtain the desired purpose. Experiments, undertaken by the Bureau of Entomology of the United States, on prickly pear stems, have given good results in determining the manner in which these stems may be used.

To begin with, the stems, cut into thin slices, are put to soak in the receptacles for the preparation of the sprays. To obtain the best result the stems should be cut in such a manner as to ensure the rupture of all the cells which contain the mucus which possesses the adhesive property.

It is remarked that the effect is not the same with all insecticides. In fact, arsenate of zinc gives the best result, then comes Paris green, but the results are almost negligible with arsenate of lead, or with the salts of iron. About 10 kilos of cactus stems are used with about 75 litres of water, and the required quantity of the arsenical insecticide added to the solution. This infusion of cactus leaves in water keeps for a very long time before its mixture with the salt, if only a little sulphate of copper be added to it.

The comparison of prickly pear with other adhesive substances employed in the preparation of arsenical sprays is in favour of the former from the point of view of its efficaciousness; and this advantage is increased by the fact that in most cases prickly pear is found in the neighbourhood of new agricultural undertakings, where it can be collected at little expense.

Prickly pear has become such a pest in many countries where it has been introduced, notably in South Africa and Queensland, that the possibility of its employment for some useful purpose seems worth drawing attention to, and the method of thus employing it, as described above, appears to present no difficulty.

SUGAR INDUSTRY.

STUDIES IN INHERITANCE IN SUGAR-CANE.

Mr. H. B. Cowgill, Plant Breeder, Insular Experiment Station, Porto Rico, contributed to the *Journal of the Department of Agriculture of Porto Rico*, January 1918, a paper on the above subject, in which he records such data as have been secured from investigations of seedlings which were being propagated and selected at that station, although only a few experiments had been conducted for the sole purpose of studying questions of inheritance in the sugar-cane.

Points of interest are: (1) the extent to which characters are inherited from the parent varieties when the latter are self-pollinated; (2) whether new types are produced in the nature of mutations; (3) to what manner and to what degree varieties when crossed can be expected to transmit their characters to seedlings.

It seems from Mr. Cowgill's observations that, in general, even when cross-pollination has not been attempted, there is a difference in the appearance and probable value of seedlings produced from the different varieties, and that there is also considerable difference in the amount of resemblance of the seedlings to the parent variety. The reason for this may be that all cane varieties are probably more or less heterozygous. It is also possible that accidental intercrossing sometimes takes place between varieties growing in the same locality, and that this affects the appearance of the resulting seedlings.

The seedlings under observation in the Porto Rico experiment station were raised from seed obtained from unprotected cane arrows. For that reason the purity of the pollen cannot be guaranteed. However, it is not probable that sugar-cane pollen is carried more than a short distance by the wind, as it has no special adaptation for being thus transported, and is soft and delicate. It is probable, therefore, that the stigmata of the flowers of the cane in the centre of a field planted in one variety, are entirely fertilized by pollen of the same variety.

The following observations on seedlings produced from five uncrossed varieties are of interest.

The seedlings produced from seed of D.109 showed a very close resemblance in outward characteristics to the parent cane every year since 1913. D.109 is a dark greenish-red to purple cane, usually reclining in habit, with buds semi-elliptical in shape. Many of the seedlings plainly show some or all of these characteristics, while the resemblance as to colour is especially noticeable.

The majority of the seedlings from seed of T.77 resemble the parent very much in colour and habit, and more or less as to the form of the bud.

Of the thirty-four seedlings produced in 1916 from the light-coloured cane, B.347, only two are of a darker shade than the parent.

The seedlings of B.109 were all like the parent variety in colour, and more or less resembled it in the shape of the internodes and the buds. A few of them however were slightly tinged with red on the upper internodes. There were however other variations among these seedlings: two were markedly glaucous, one had specially prominent buds, one had extremely small joints, two had many adventitious roots, one had especially thin stalks, one was very thick-stalked. There was also a great difference amongst these seedlings as to vigour of growth.

Out of 366 seedlings from D. 448, which is a red cane, 60 per cent. showed redness on the stalk, though some in a less degree than in the parent variety. Among the remainder there were two wine-coloured canes, two greenish yellow, two reddish green and glaucous, three were light reddish green and glaucous, and one had distinctly tumid joints.

All seedlings produced from D.117 seed showed marked resemblance to the parent in colour and habit of growth, but they have shown much variation in the type of the internodes and the bud. Abnormalities, rendering a cane unfit for commercial cultivation, such as dwarf canes, extremely short internodes, and wedge-shaped internodes, have been common in these seedlings. Of the 900 seedlings of this variety grown to maturity in 1916-17, only one differed in colour from the parent variety, being green instead of yellowish green. Twenty-four of them were classed as abnormalities, nine of which were dwarfs. They had stalks not over 3 feet long, internodes $\frac{1}{2}$ to 1 inch long, usually semi-prominent buds, and erect growing leaves. Other unusual characters in these abnormal canes were stalks with all or many of the buds sprouted, and stalks with many adventitious roots. Some plants also had stalks with wedge-shaped internodes, averaging about 1 inch long on one side of the stalk, and narrowed down to sometimes practically nothing on the opposite side. It is planned to grow some of these variations to see whether the abnormal characters are inherited.

It may be that such unusual types are due to characters acquired by intercrossing of various types of cane at an early stage in the development of the species, and that these characters have been hidden by reason of the dominance of others, since the sugar-cane has been propagated asexually for an unknown period of time. But the question also arises whether such abnormalities are not of the character of mutations, and whether some of the other variations in cane seedlings may not also belong to the same class.

The following interesting observations were made by Mr. Cowgill with regard to seedlings produced by pollinating the flowers of the Crystallina cane with pollen of D.109. These seedlings show resemblances to both parents; some of them were almost identical in appearance with the pollinating variety, while a few closely resembled Crystallina. Between the two types many variations were found. Where the parents are not so distinctly different in colour as these two varieties, it may not be absolutely certain whether individual seedlings are from cross-pollination or from self-pollination of the variety intended for the seed parent. On a whole, however, the progeny can be considered cross-pollinated seedlings.

Of the canes resulting from this cross-pollination last year, many appear promising for commercial culture. Only one abnormal stool was found among them. The data obtained from the comparison of the characteristics of these cross-bred seedlings indicate that there is a form of combination of characters in some at least of them, resulting from the cross. There is a greater variation also in seedlings so produced than in those obtained from flowers not cross-pollinated.

DEPARTMENT NEWS.

Dr. C. P. Stoute, M.D.V., Government Veterinary Surgeon, St. Vincent, has resigned that office, on his appointment by the local Government as Inspector of Imported Animals in Barbados.

EXPERIMENTS IN YAM AND CASSAVA CULTIVATION IN TRINIDAD.

At a meeting of the Board of Agriculture, Trinidad, a full report of which appeared in the *Port-of-Spain Gazette*, May 17, 1918, Mr. W. G. Freeman, Acting Director of Agriculture, submitted some interesting facts with respect to experiments in the cultivation of yams and cassava which had been carried out at the St. Augustine Experiment Station by the Agricultural Officers in charge. The results of these experiments will be useful to those interested in the cultivation of these crops.

The yam plants were put into the ground at the end of May and the beginning of June 1917, and were reaped in the last two weeks of February 1918.

In the first experiment on the yield of three different varieties—Barbados Lisbon, Horn, and Red yams—these were planted in trenches 3 feet apart, the plants being 2 feet apart. The Lisbon proved a most prolific yielder, giving an estimated yield of 18·47 tons per acre, which at 3c. per lb. would be a crop of the value of $1,241·18 per acre.

A second experiment was made with the object of ascertaining whether it was preferable to use the top, centre, or bottom portions of the tubers for planting purposes. The results showed that the difference is very small, and within the limits of experimental error. There is apparently therefore no advantage in selecting any special part of the tubers for planting purposes. A third experiment with regard to the method of planting had for its object the determination of two points: (1) whether it is more profitable to plant in holes or in trenches, and (2) what is the best planting distance.

In this experiment trenches were dug 2 feet wide by 18 inches deep, 4 feet apart, and planted at distances of 18 inches, 2 feet and 4 feet apart, respectively. One set of holes was dug 2 feet wide by 18 inches deep, at distances of 4 feet by 4 feet, and 4 feet by 3 feet, respectively. Another set of holes was dug 2 feet wide but only 8 inches deep; trash and manure were applied to one-half of these holes as is usually done, whereas no trash nor manure was put in the others, which were simply refilled with loose earth from around, and the soil drawn up in a hill over the holes

Barbados Lisbon yams were planted throughout these plots.

The results obtained showed that, notwithstanding the higher cost of preparation, it is more advantageous to have deep holes, i.e, 18 inches deep. It also was shown that a larger profit is obtained per acre from close than from distant planting; 3 feet by 2 feet or 4 feet by 18 inches has given the best results. It should be mentioned, however, that the further distances give a larger return per hole, and the largest yams. But this is not an advantage, as very large tubers do not sell as readily as smaller ones. Trenching is more expensive than holeing, but as it permits of closer planting it is likely to be more profitable.

Moreover, the land is better prepared for subsequent crops, especially if the untrenched portion of the first year is worked up for the second year. Holes 4 feet by 3 feet gave 1,460 tons and $782·49 net profit per acre. Trenches 4 feet apart, planted at distances of 18 inches and 2 feet, gave 1,506 and 1,422 tons, with a profit of $745·90 and $703·06 per acre, respectively. With trenches 3 feet apart and planted at a distance of 2 feet, a yield of 1,847 tons was obtained giving a profit of $975·06 per acre.

To ascertain what would be the loss on yams if stored for a long time, 100 lb. of freshly dug yams were weighed on February 13, and reweighed at intervals of three or four days. On April 26, about ten weeks later, they had lost 10 per cent. in weight. During the last two weeks, however, the loss in weight was very slight.

The total area under yam cultivation at St. Augustine Experiment Station during 1917 was 14,462 square feet, or practically $\frac{1}{3}$-acre, from which 10,090 lb. of yam were reaped, i.e. 13½ tons per acre. The value of the crop at 3c. per lb. works out at $911·73, and the total cost of cultivation, including the purchase of plants, was $197·85 per acre, leaving a profit of $713·88 per acre.

Experiments in the cultivation of cassava on the yield of fifteen varieties showed between 5·31 and 7·41 tons of roots per acre.

With regard to the best planting distance for cassava, it is found that 3 feet by 3 feet has generally given the highest yield per acre. It also appears that the centre portion of the stems is more suitable for cuttings than either the less mature or the very old portions.

An experiment for testing the relative merits of planting on the flat, on banks, or in forked holes showed that though a slight increase may be obtained trom the two latter methods, the increase in crop scarcely justifies the extra cost of banking or holeing.

A new experiment was started with the object of ascertaining which was the best month or time for planting and reaping cassava. Accordingly, from May 23, 1916, and thence monthly, duplicate plots were planted of the some variety. All of these plots were reaped between October and November 1917, so that the cassava was from six to seventeen months old when reaped.

In another set of experiments, twelve duplicate plots were planted between April 29 and May 4, 1916. Two plots were reaped on November 2, 1916, and thence monthly, so that the cassava was also from six to seventeen months old when reaped. The percentage of starch was estimated in samples from all of these plots.

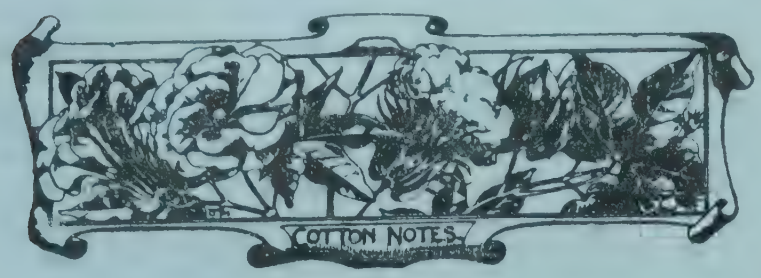
The results obtained from these experiments show that:

1. The yield of roots has increased generally from month to month with the age of the plants, and it is probable that a still larger yield would have been obtained if the plants had been allowed to remain more than seventeen months. It was 1·29 tons at six, and 5·80 tons at seventeen months.

2. The percentage of starch does not necessarily increase with the age of the plants, but depends chiefly on the weather prevailing at the time of reaping. For example, the highest percentage of starch (28·9 per cent.) was obtained in March from cassava ten months old, whereas the same variety sixteen months old, reaped in September, only contained 19·47 per cent. of starch. This is entirely due to weather conditions, i.e. the ten-months-old cassava was reaped during the dry season, whereas the sixteen-months-old cassava was reaped in rainy weather. Although the yield of roots in September was nearly 30 per cent. more than that reaped in March, still a larger amount of starch was obtained in March than in September, viz. 1,534 lb. as against 1,348 lb. per acre.

It is evident, therefore, that the best time for reaping cassava is in the dry season, about February-March, and the cassava should then be not less than fifteen to seventeen months old, so as to obtain a good yield of roots. These experiments, however, do not show conclusively which is the best time for planting.

Incidentally these experiments show that a yield of not less than 1½ tons of starch per acre may be obtained from cassava seventeen months old, reaped in March.



COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended June 1, 1918, is as follows:—

ISLANDS. During the past fortnight the market has remained very quiet, with little inquiry.

The unsold stock consists of odd bags, classing Fine to Fully Fine, as the Planters' crop lots have been sold. The Factors are showing more disposition to sell, but continue to ask previous prices, being still unwilling to admit that they will sell at any concession in price. However, with orders in hand we can probably buy at some decline from quotations.

We quote, viz:—

Extra Fine 75c. to 80c. = 77c. to 82c., c.i.f.
Fine to Fully Fine 72c. to 73c. = 74c. to 75c. ,,
Fine to Fully Fine, off in preparation, 70c. = 72c. ,,
Fine to Fully Fine, stained, 65c. = 67c. c.i.f.

GEORGIAS AND FLORIDAS. Since our last circular report the market has been generally quiet, with Factors holding average Extra Choice at 72¼c., for which there has been limited demand. However, during the past few days small orders have come into the market, resulting in sales of about 250 bales Extra Choice to Fancy at 73c., taking some lots of good cotton which were seeking sale.

We quote viz:—

Extra Choice to Fancy 73c. = 75c., c.i.f.
Average Extra Choice 72¼c. = 74¼c. ,,

The exports during the past two weeks have been large, there having been shipped from Savannah 2,202 bales to New York and 1,075 bales to Boston, and from Jacksonville to Northern Mills 766 bales. The larger part of these shipments are reported to be Government cotton, which is being forwarded to the mills which have contracts for the Government. Consequently the cotton is going into consumption.

This movement serves to encourage the holders of the unsold stock to think that all of this crop may be required before the next season opens, and that they will find a market for this cotton on a basis of prices current.

Local Prices of St. Vincent Cotton, 1916-17. —Mr. W. N. Sands, Agricultural Superintendent, St. Vincent, has forwarded to this Office some figures as to the results of the co-operative purchase of cotton by the Government ginnery in that island for the 1916-17 crop.

For first grade white seed-cotton, the payment on account and the final bonus netted the seller 17½c. per ℔., or at the rate of 70c. per ℔. of clean lint.

The seller of white Marie Galante cotton netted in the same way 10⅘c. per ℔. of seed-cotton, or at the rate of 43⅕c. ℔. of clean lint.

PROSPECTS OF COTTON PRODUCTION IN SOUTH AFRICA.

In an article on this subject in *The Board of Trade Journal*, April 25, 1918, it is stated that according to the latest figures, there are approximately 5,200 acres under cotton cultivation in the Union. The total yie'd for the season 1916-17 was 700,000 ℔. of seed-cotton and 233,000 ℔. of lint. Throughout the Union there are considerable areas where the soil and climatic conditions are suited for this cultivation. The type of cotton which appears to be best adapted to South African conditions is the American Upland variety.

For the proper production of cotton, the rainfall should increase from the time of planting until flowering sets in, and then decrease until harvesting time, which should take place in dry weather. These conditions are fulfilled in South Africa. The rains begin in October, and increase in volume until January, when they gradually decrease, and by the end of May the rainfall practically ceases. Dry weather during the maturing and harvesting periods is especially favourable to cotton production. These conditions do not always prevail in America, where the cotton is often damaged by rain before it can be picked. In the sections of South Africa suitable for cotton cultivation, the rains have generally ceased by harvesting time, so that practically no cotton is damaged by excessive moisture after the bolls open.

In the Union there are vast areas of virgin soil of suitable types for cotton cultivation, which are located where favourable climatic conditions prevail, and which could be utilized for a large increase of cotton production. As compared with the conditions which prevail in the cotton belt of the United States of America, it would appear that the soil and climate of South Africa are eminently suitable for the cultivation of this crop. In the sugar-producing area of Natal and Zululand, cotton is recommended, as being the most suitable and remunerative crop which can be used for the purpose of rotation with sugar-cane.

Reports on South African grown cotton place it on a considerably higher grade than Middling American. On account of this fact, there is an idea that South African cotton is much superior to any Upland cotton produced in the American cotton belt. This is erroneous, but it is true that South African cotton is generally of better quality than the bulk of the Upland cotton grown in the States.

As South African cotton is of the same type as that produced in America, it can be used by spinners for the same purposes. This class of cotton supplies the bulk of the cotton trade both in England and on the Continent, so that there is no fear of not finding a market for the South African product.

The St. Vincent *Sentry*, June 14, 1918, notes that although the current market quotations in London for arrowroot are at present very good, the impossibility of securing tonnage to convey arrowroot to the United Kingdom is preventing the St. Vincent producers from obtaining the benefits of the higher prices. The wisdom of not relying on one crop is now evident. The planters who, besides producing arrowroot, have devoted a portion of their land to the cultivation of cotton, are now perceiving the advantages of such a policy. The assurance of immediate spot cash purchase of the entire crop of the colony by the Government is another reason for directing attention towards the production of cotton.

RESULTS OF FOOD PRODUCTION CAMPAIGN IN ENGLAND AND WALES.

The Director-General of Food Production for England and Wales, Mr. A. Lee, has just issued an interim report which is of great interest to the whole of the Empire, as showing the wonderful response that has been made by the farmers of the mother country to the demand for increased food production.

The report states that an official and compulsory census, obtained on April 27, 1918, from occupiers of land in England and Wales, shows the following total acreages up to that date:—

Corn and Potatoes.

Crop.	Acres.	Increase over 1916. Acres.
Wheat	2,665,000	752,000
Barley	1,490,000	58,000
Oats	2,820,000	735,000
Rye, dredge corn, and pulse	682,000	280,000
Potatoes	645,000	217,000
Total acreage	8,302,000	2,042,000

Complete returns of the acreage of grass land ploughed are not yet available, but a compulsory census, taken on March 11, 1918, showed that over 1,800,000 acres of permanent grass in England and Wales had been broken up by that date, and it is estimated that a total addition of not less than 2,500,000 acres to the tillage area of England and Wales (as compared with 1917) has now been made.

If, as may be anticipated from the recent forecast of the Boards of Agriculture for Scotland (300,000) and Ireland (1,500,000), the corresponding addition to the tillage area in those two countries will approximate to 1,800,000 acres, the total for the United Kingdom will be well over 4,000,000 acres.

The foregoing figures indicate that the total acreage in the United Kingdom under wheat, barley, and oats in 1918 will be the highest ever recorded in the history of British agriculture. The acreage under potatoes will be the greatest since 1872. Particulars of other crops are not yet available.

It is, of course, not possible to foretell the quality of the coming harvest, but, speaking generally, the present condition of crops is very promising, and gives reasonable hope of at least an average yield.

Proceeding upon this assumption, and further assuming that (after deducting seed and light corn) the whole of the wheat and barley crop, one-fifth of the total oat crop, and one-quarter of the potato crop (i.e. the surplus above normal consumption) could be made available for bread-flour in case of need, it may be reckoned that the United Kingdom harvest of 1918 could provide forty weeks' supply of breadstuffs for the entire population at the present scale of consumption, and on the existing basis of milling.

The English and Welsh harvest would further provide concentrated feeding-stuffs for animals (in excess of the normal home productions of oats reserved for this purpose) to the amount of some 500,000 tons, besides additional oat straw equivalent to at least 350,000 tons of hay.

Reckoned in tonnage, the net saving in shipping resulting from the increased production of corn and potatoes in England and Wales alone, should amount in the coming year to 1,500,000 tons.

The foregoing figures relate only to holdings of 1 acre and upward, and take no account of the increased produce from allotments and gardens. These, however, contribute very largely to the supply of home-grown food. The increase in the number of allotments alone since 1915 is not less than 800,000 in England and Wales, or 140 per cent. The additional weight of foodstuffs produced by this expansion may be reckoned at not less than 800,000 tons above the normal.

Whereas the production of home-grown breadstuffs in the United Kingdom was only sufficient for supplying the population with food for one-fifth of the year in 1915-17, it is estimated that in the present year, 1918-19, the production will suffice for the provision of food for four-fifths of the year.

These results, so far as Great Britain is concerned, have been achieved under exceptional difficulties created by shortage of labour. In England and Wales alone there are over 200,000 fewer male labourers on the land to-day than in the year before the war, even after crediting all military and prison labour furnished by the Government. This fact by itself is a sufficient proof of the energy, resource, and patriotism with which all sections of the agricultural community have devoted themselves to the service of their country.

COURSES OF READING AND EXAMINATIONS IN PRACTICAL AGRICULTURE.

On the occasion of the presentation at the Antigua Grammar School on June 4, of certificates awarded by the Imperial Commissioner of Agriculture to three successful local candidates for the Intermediate Examination in Practical Agriculture, Mr. Collens, the Acting Superintendent of Agriculture for the Leeward Islands, remarked that these certificates, issued to successful candidates, were evidences of a certain amount of proficiency, which he was pleased to state was well recognized and acknowledged by the planters in that island. In the local Department of Agriculture all junior officers and cadets are expected to graduate in this course.

In this connexion it may be well to draw again the attention of readers of the *Agricultural News* to the courses of Reading and Examinations in Practical Agriculture, which are annually conducted under the auspices of the Imperial Department of Agriculture.

They were established in the year 1909 for the purpose of enabling overseers on estates, and others engaged in the practice of agriculture, to acquire, from reading, knowledge which they can apply to their practical work. The syllabus and suggested courses of reading were revised in 1913.

Examinations are held during October and November each year at the Agricultural Stations of the various islands. There are three examinations in the series—Preliminary, Intermediate, and Final. Each examination consists of two parts, written and oral.

Persons who wish to take the examinations must be registered as students, and the examinations must be taken in order.

Candidates who are successful in passing the prescribed examinations are awarded certificates by the Imperial Commissioner of Agriculture.

It is intended that the possession of the three certificates shall be a guarantee of a sound, general knowledge underlying the practice of agriculture, and also a practical knowledge of at least two of the principal crops grown in any particular district.

Information concerning these Reading Courses and Examinations can be obtained from local Agricultural Departments.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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SCIENTIFIC STAFF.

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*Seconded for Military Service.
†Seconded for Duty in Egypt.
††Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

In the editorial, attention is drawn to the progress made in recent years in breeding new varieties of plants, and to some of the problems connected therewith.

Under Insect Notes, page 202, will be found a description of the South American locust, which has recently been causing considerable damage in British Guiana.

An eel-worm disease of bananas, which has been found in Grenada, is described under Plant Diseases on page 206.

On the same page will be found some notes on certain corky woods of the West Indies.

Visit of American Zoologists to the West Indies.

The party of zoologists from the State University of Iowa, under the direction of Professor C. C. Nutting, whose visit to Barbados was noted in the *Agricultural News* for May 18, 1918, left that island on June 17 with the intention of staying a few weeks in Antigua, where they will continue their biological studies on the fauna of these seas.

On their departure Professor Nutting wrote to the Barbados papers, expressing the appreciation by the party of the hospitality received by them during their stay in Barbados, and of the assistance rendered to them by the local Government.

Work of the Jamaica Imperial Association.

The recently formed Jamaica Imperial Association, to which attention was drawn in the *Agricultural News*, June 1, 1918, is putting forth energetic efforts, as is shown by the report of a special meeting of the Association's Council published in the Jamaica *Gleaner*, May 18, 1918, to induce the larger land-owners in that island to engage in more extended cultivation of foodstuffs. From the speeches made it is evident that the aim of the Association in regard to the question of food supply is two-fold: it is Imperial as well as local. It desires that Jamaica should produce locally a considerable increase of foodstuffs, in order that the mother country may benefit by the saving made in the colony in the consumption of imported food. It also aims at securing Jamaica against actual want of food, and at protecting the population from exorbitant prices, which naturally would result from great scarcity.

At the meeting referred to, it was resolved to obtain from proprietors of 40 acres and over personal guarantees that they will put land under cultivation in foodstuffs, and establish the crops.

The form of agreement which was decided upon reads as follows: 'We, the undersigned, in view of the urgent necessity for increasing the food supply of the island, hereby undertake to put under cultivation in foodstuffs on the property undermentioned, the number of acres mentioned opposite the name of such property, apart from any tenants' cultivation.'

The Chairman, Mr. A. W. Farquharson, estimated that, as a beginning, it would be necessary to cultivate some 33,000 additional acres. Furthermore, if Jamaica was to succeed in supplying herself with substitutes for the cereals imported during 1916-17, it would be necessary to cultivate twice or three times as many additional acres. He did not think that the seriousness of the situation had been fully realized.

The Situation of the Lime Industry in Dominica.

Attention was drawn in the *Agricultural News*, May 18, 1918, to the serious effect likely to be produced on the lime industry of Dominica by the embargo placed on the importation of green limes into the United States. The following note as to the present situation

has been recieved from Mr. J. Jones, Curator of the Botanic Garden in that island:—

'From recent information received, it would appear that there is no likelihood of the American embargo on green limes being raised. There are some hopes that citrate of lime may be admitted. If this is allowed, it may permit of bying on a limited scale for making this product.

'As a result of the embargo, the fruit usually shipped as green limes will now have to ripen on the trees and to be turned into concentrated juice or citrate of lime. The addition to the ripe lime crop will probably amount to 50,000 or 60,000 barrels of fruit, and for these approximately 1,000 casks of 40 gallons capacity will be necessary in addition to ordinary requirements. Enquiries are being made by the Government with a view of obtaining the extra packages needed.

'His Honour the Administrator has addressed a Circular to the leading planters asking them to assist by buying peasants' limes, and, if possible, to do so on a co-operative basis.

'The business of buying limes by planters will naturally be a speculative one, as the future market position of concentrated lime juice is uncertain. It is clear that buyers can only offer a low price, therefore the small growers are likely to experience a very trying time.

'News has just been received that Messrs. Rose & Co., Ltd., have resumed the buying of limes and lime juice. It is however not yet known whether the firm will be able to buy throughout the crop season.'

Testing New Cane Seedlings in North India.

A note on this subject by Dr. C. A. Barber, Government Sugar-cane Expert, Madras, appears in the *Agricultural Journal of India*, April 1918.

The cane-breeding station at Coimbatore, which is under Dr. Barber's direction, was founded with the aim of obtaining better varieties of cane than those at present grown in India. This aim is complicated by the fact that the canes experimented with are divided into two classes: thick tropical canes, and thin indigenous ones. There are already many excellent thick canes in the country, but the thin ones are generally of very inferior qualities.

To obtain seedlings of promise of the thick varieties presents no difficulty, and a large number has been raised at the station, some of which it is hoped will prove of value in cultivation. The raising of seedlings of the thin varieties, so as to replace the indigenous class with plants of greater value, is more difficult, but because of the greater area devoted to the cultivation of these indigenous canes, their production has received most attention.

Seedlings raised with this object are chiefly crosses between thick tropical canes and hardy Indian ones. It is noticeable that in the seedlings raised a distinct advance has been made towards the problem of obtaining varieties suited to the different conditions of North India sugar-cane districts.

Dr. Barber points out that the work on the Coimbatore cane-breeding station is necessarily very different from that in tropical countries, where only the thick varieties are paid attention to. A yet more important difference is that improved seedlings are wanted for places where the climate and the soil are very different from those at the station. It has therefore been decided to start a tentative distribution of some of the most desirable seedlings, obtained by crossing tropical canes with thin Indain varieties, on certain North Indian provincial farms. It is important that the period of testing should extend over several years, because it takes some time for a seedling to accommodate itself to the vegetative mode of reproduction, as well as to acclimatize itself to the very different conditions of soil, temperature, and moisture it its new surroundings. Dr. Barber gives a striking instance of this. A certain cane was distributed because of its rich sucrose content; it refused to grow more than a couple of feet in length for the first four years, but was kept because of the richness of its juice; in this, the fifth year, it has suddenly grown well, and the juice does not seem to have suffered by the change.

There are numerons instances, says Dr. Barber, in Indian experience of the past twenty years, of such gradual acclimatization.

The seedlings thus far grown to maturity have been numbered Madras 1-1,7000. A new series of numbers will now be started of such canes as are, after testing in the provincial farms, considered worth trial in the field. The new series will be termed 'Coimbatore' seedlings, and designated 'Co. 1, 2', etc.

Sugar as a Meat Preservative.

A note in the *Queensland Agricultural Journal*, April 1918, draws attention to the employment of sugar instead of salt as a preservative for meat. It is stated that hams may be placed in a 'pickle', if it is possible so to call it, of sugar and molasses. The fresh hams are first well rubbed with powdered sugar, and are then placed in the saccharine solution, and left undisturbed for some weeks. When cooked the meat does not present the red appearance of the brine-cured article, but looks more like fresh pork. The taste however is said to be like that of ham, only a little sweeter. It is stated in the same journal that experiments have been made under the direction of the French Minister of Agriculture, which demonstrate that sugar possesses some advantages over salt as an agent for preserving meat. It is pointed out that salt absorbs a portion of the nutritive substances and of the flavour of the meat, and the more deeply it enters the tissues so much the more readily does it deprive meat of some nutritive substances of genuine importance. Powdered sugar, on the contrary, forms round the meat a sort of solid crust, which removes very little juice from the meat, and does not alter its taste. It is sufficient to immerse the meat in water, before cooking. It is true, however, that preserving meat by sugar costs a little more than its preservation by salt.

INSECT NOTES.

THE SOUTH AMERICAN LOCUST IN BRITISH GUIANA.

Towards the end of June 1917 British Guiana was visited by a vast swarm of locusts which entered the North West District from Venezuela, and spread down to the mouth of the Pomeroon River and the Essequebo Coast. An interesting account of this invasion is given by Mr. G. E. Bodkin, Government Economic Biologist of British Guiana, who had the opportunity of observing the swarm in most of the invaded districts soon after its arrival. (*Journal of the Board of Agriculture of British Guiana*, Vol. XI, No. 1, January 1918.) A previous notice of the arrival of this locust (*Schistocerca paranensis*) appeared in the above journal for April and July 1917.

The swarm was described by eye-witnesses in various ways; 'some likened it to a cloud in the sky which temporarily obliterated the light of the sun, while the sound of their flight is well represented by the wind-stirred rustlings of a multitude of dead and dried leaves evenly sustained and heard from afar.'

The locusts gradually distributed themselves over a large area, and almost every cleared and cultivated piece of land on the forest received its detachment. It is considered that this vast swarm originated on some of the large islands at the mouth of the Orinoco, and a portion of the swarm is known to have reached the Penal Settlement on Essequebo River some 200 miles to the south-east. These locusts covered most of this distance in flight against the wind. As each detachment settled down the insects immediately began feeding greedily. Indian corn and cassava seem to have been preferred in almost every instance, and these crops were quickly stripped of all foliage. Feeding was done largely at night. When disturbed, the adults flew strongly, and invariably went off down wind, so that capture was extremely difficult. Therefore, hardly any attempts were made to control the swarm at the time of the invasion, since the cost of the labour expended would have been out of all proportion to the number of locusts destroyed. Within a fortnight of their arrival the two sexes were observed mating, and egg-laying began. The eggs are deposited beneath the surface of the soil, the female boring a hole by means of certain hardened processes at the tail end of the body. A depth of from $1\frac{1}{2}$ to 2 inches is reached, and oviposition begins. The female first exudes a small quantity of froth and then lays her eggs rapidly, mixing them with more froth. Finally a large quantity of froth is exuded to seal the hole. The froth soon hardens, forming a protective covering for the eggs, and causing them to adhere together in a rough cylindrical mass, conforming to the shape of the hole. Mr. Bodkin mentions that in spite of these precautions the eggs may be attacked by enemies, an egg-parasite having been bred out from a mass of these eggs dug up in a field in the North West District.

It was observed that on the pegass soils in this district egg-laying took place on the drier and more rigid patches. The writer continues: 'A favourite locality seemed to be where a palm had originally stood, and the network of decaying roots mixed with soil was almost universally selected. The somewhat higher ground on the edge of the draining trenches, and on the drains themselves, was also utilized. On the sandy soils which prevail in certain districts the eggs were deposited in any open space. During the early evening hours from about 3.30 to 5.30 this operation took place. An open piece of sandy soil with several hundreds of locusts all busy ovipositing presented a most peculiar spectacle. So engrossed were the locusts in their occupation that it was an easy matter to seize them between the finger and thumb and forcibly remove them.'

It is stated that the eggs are about the size of a well matured grain of rice, and of a dull yellowish-brown colour. During development they increase slightly in size and become softer, while a greenish tint appears. Finally the eyes of the embryo can be seen through the shell. In the process of emerging the young locust ruptures the shell longitudinally.

Mr. Bodkin found that none of the farmers whose land was invaded by the locusts had any idea of the real significance of the vast swarm, and of its capabilities of sudden enormous increase. So that when the young hoppers began to emerge in countless numbers, there was general disillusionment and consternation, and the question of control immediately became urgent.

A number of control methods were devised to meet the varying local conditions, and were everywhere effective. During the dry weather large numbers of the young locusts, or 'hoppers', could be destroyed by burning. Whenever a large swarm was found it was surrounded by dry and inflammable bush, which was then fired. This method was very effective against the younger stages up to the third stage, but the older hoppers were in many cases able to jump through the ring of fire and escape. It was found that it was useless to burn a swarm in high grass, since the majority made their way down to the damp tangled growth at the roots, and thus avoided the fire.

Various methods of trapping the young hoppers were tried with excellent results. Small canvas sheets, banana leaves, etc., were smeared with tar, and clusters of young locusts were brushed off to these tarred surfaces, where they stuck and soon died.

In another district the insects were driven into draining trenches where the surface of the water had previously been covered with a film of kerosene, and were effectively killed.

The following ingenious method of control is described by the writer as being introduced by Mr. E. S. Nicholson, of of Anna Regina: 'Tarpaulins about 12 feet square were smeared with the thickest molasses. A large swarm of hoppers having been located, this sheet was laid out on the ground in the proposed direction of the drive. The swarm was then surrounded by a number of individuals and gently yet firmly urged towards the tarpaulin. Obviously this method can only be exercised where the *terrain* is only slightly encumbered by vegetation. It would be quite impossible, for instance, to utilize such a means in high grass. For wholesale destruction of well matured hoppers in large swarms this method cannot be approached.'

Poisons were used to a very small extent by the people, although abundant supplies of these were available from the Government at half the original cost price. This was attributed to the fact that many of the small land-owners can barely eke out an existence, and that they are probably unfamiliar with the handling of poisons.

In some instances it was found necessary to deal with recalcitrant land-owners under the Insect Pests and Plant Diseases (Prevention) Ordinance, which in 1914 became a law of British Guiana. But in the great majority of cases the small farmers and grant-holders co-operated to combat the locust invasion, and thus averted a danger which menaced the whole colony. With the exception of two districts where the hoppers have reached the adult stage and are thus capable of flight, the pest has been eliminated from British Guiana.

J.C.H.

THE VALUE OF GARDEN COMPETITIONS.

The writer of an article on the above subject, appearing in the *Agricultural Gazette* of Canada, for May 1918, commences by saying that, if he were asked to state in a few words what is the greatest value of a garden competition, he should say, 'It is the inspiration to greater effort and higher achievement.' Full exemplification of the truth embodied in this brief statement may be found in the results obtained by the institution in many of the West Indian colonies of Peasants' Exhibitions so successfully carried out under the auspices of the Imperial Department of Agriculture several years ago, and in the extension and further development of Prize Holdings Competitions, having for their object the encouragement of greater attention being devoted by peasants to the cultivation of certain economic crops in these islands. These prize holdings schemes and peasant exhibitions have been shown to be most valuable agencies for improving the general condition of the holdings of small proprietors in the islands where they have been successfully established; there can be no doubt as to their value also to the immediate community or locality in which they may be located.

Although the garden competitions referred to by the writer in the *Agricultural Gazette* quoted above, might not be altogether on all fours with the prize holdings schemes and peasant exhibitions of the West Indies, yet the objects apparently aimed at are not dissimilar, but rather of relative importance; and the observations in regard thereto cannot fail to be of interest, and also instructive to competitors in prize holdings competitions in these islands.

Describing the different orders of garden makers, the writer says these may be divided into several groups: first, those who are enthusiastic and ignorant, but anxious to learn; second, those who are ignorant, but too confident or conceited: they have the confidence of ignorance, which is not an uncommon characteristic of the man or woman who has read a great deal about gardening, and thinks he or she knows all about it, although his or her practical experience is very small. Then there is the skilful and successful gardener who has good reason for thinking himself in a class by himself, but fails to recognize the merit of others; and, finally, there is the enthusiastic, successful, and skilful gardener, with his place clean and in good order, always on the look out for information, and eager to impart his knowledge to others.

A garden competition, the writer very truthfully remarks, puts each of these gardeners into the proper place, and opens the eyes of each to individual shortcomings, and to the skill and good taste of others. The gardener, in thus having a proper value placed by the judge, gets both information and inspiration to greater effort next year. Moreover, the friendly rivalry which a garden competition brings about, leads to intercourse which would not otherwise take place; and the visits which competitors pay to one another's gardens, and the observations made from the street, and the new varieties which they are becoming acquainted with, do much to bring about a greater incentive to improvement, and thus the standard of each is raised.

Not only is the owner of the garden benefited by the competition, but naturally the whole family is more interested in the garden than they would be if it had not been entered in the competition; and there is no doubt that the younger members will be more likely to make gardens of their own later on, if they go from a home where there has been a good garden.

Then there is the value of a garden competition to the district or community. Good gardens scattered here and there through the country give an enviable reputation to the community, and the more good gardens there are, the better the reputation. If a garden, through the special effort which a competitor makes, becomes conspicuously better than those near by, the likelihood is that the owners of the latter will at least keep their places neater than they otherwise would do. It is seldom that a garden which has been raised to a certain standard through the efforts made to win a competition, is allowed to return to the condition it was before.

PROPOSALS FOR THE PRODUCTION OF POWER-ALCOHOL IN AUSTRALIA.

Attention was drawn in the *Agricultural News*, Vol. XVI, p. 325, to the appointment of a Special Committee by the Advisory Council of Science and Industry of the Commonwealth of Australia, to enquire into the production of power-alcohol. This Committee, it is stated in *The Board of Trade Journal*, April 18, 1918, has now published its report. The Committee state that the question of the utilization of power-alcohol on an extensive scale naturally divides itself into three main problems—the production, utilization, and denaturation of alcohol.

As regards production, it appeared that the most suitable raw material at present available is the sugar molasses in Queensland. This, however, is insufficient, as it would only be sufficient for the manufacture of a little more than 3,000,000 gallons of alcohol, whereas the annual requirements of Queensland alone exceed this. There are, however, certain other materials, such as sorghum stalks, cassava, and sorghum grain, which would offer favourable opportunity as a source of alcohol. As these crops are only grown on a small scale in the Commonwealth at present, the Committee cannot state whether they can be cultivated profitably as a raw material for the manufacture of alcohol. If some stimulus or inducement were offered for the manufacture of alcohol, it appears that there is a favourable opportunity for the establishment of a new and important industry in the Commonwealth.

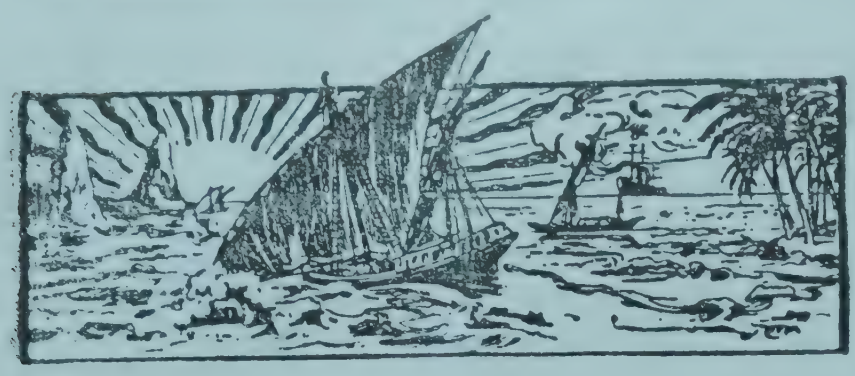
As regards the utilization of power-alcohol, experiments have shown that it can be used with success in internal combustion engines. It is not likely, however, to be more economical in the near future to substitute alcohol for kerosene in engines designed to use the latter as fuel, but in this connexion the possibility of a shortage in the supply of kerosene must be borne in mind.

In order to develop the use of alcohol for power purposes, and to encourage the production of the raw materials upon which the manufacture of such alcohol depends, the Committee recommended:—

(1) That necessary action be taken to allow of the manufacture and use in Australia of power-alcohol denatured with 2 per cent. of ether.

(2) That an allowance at the rate of 3*d.* per gallon be granted by the Commonwealth Government on power-alcohol denatured in the above manner, and manufactured in Australia from raw material produced in Australia, by reimbursement of the extra cost caused by fiscal restrictions on the manufacture of alcohol.

(3) That a bonus, also at the rate of 3*d.* per gallon, be granted by the Commonwealth Government on such power-alcohol, in order to encourage its manufacture, and to develop the primary industries on which the supply of the necessary raw material depends.



GLEANINGS.

The best method of growing tomatoes is to train the plants to one stem, planting them 18 inches apart, in rows about 3 feet apart, or in a single row. Rooted cuttings produce earlier fruit than seedlings. (The *Queensland Agricultural Journal*, April 1918.)

Sisal is second only to cotton in being the most extensively used fibre in the United States. Its importance for the manufacture of binder twine is steadily increasing. The only important sisal-growing portion of the United States is the territory of Hawaii. (The *Hawaiian Forester and Agriculturist*, February 1918.)

A report has been submitted to the Federal Food Administrator showing that every sugar plantation in the Hawaiian territory is now engaged in producing food for its own consumption. Many acres of hitherto idle land have been turned into large gardens for the production of foodstuffs. (The *Louisiana Planter*, May 4, 1918)

The *Port-of-Spain Gazette*, May 7, 1918, says that Tobago will again maintain her first place this year as far as food production is concerned. All round the island can be seen large areas of prepared land for the planting of corn and peas as soon as the first heavy rains come on. Good for Tobago! There is certain money in corn and peas this year.

Sir Charles Mandleberg of Manchester, has written to the editor of this Journal, drawing attention to a scheme which he has put forward for increasing the British export trade by the formation of a British Manufacturers' Corporation. It would appear that already some 250 firms in various industries have agreed to be associated with the proposals put forward.

The Dutch East Indies are the world's chief producers of nutmegs and mace. The production of these spices in Grenada in the British West Indies has increased during the last few years, and the value of the crop exported in 1915 was over £42,000. The cultivation of nutmegs, however in Penang, Straits Settlements, has steadily declined. (*The Times Trade Supplement*, April 1918.)

In an article dealing with the production of cotton in the Sudan, the *Agricultural Journal of India* for April 1918, says that the general character of the cotton grown is excellent. It is entirely of the Egyptian type. The most striking feature of the district is the way in which the Government, by careful control of the native handling of the crop, has secured and maintained a high level of quality in the product as a whole.

In the *Hawaian Forester and Agriculturist*, February 1918, it is stated that during the past two years experiments have been carried on in Hawaii to produce a hybrid plant derived from the two parents, henequen (*Agave rigida*, var. *elongata*) and sisal (*A. sisalana*). It is hoped that this hybrid will produce the superior qualities of fibre obtained from *A. sisalana*, and partake of the much desired quality of the long life of the henequen.

As a result of experiments on the culture of native yellow flint maize in the Philippines, recorded in the *Philippine Agriculturist and Forester*, March 1918, it is stated that the strains which take longest to mature, that is about 100 days, are heavier yielders than those which mature in ninety days, and that the tall-growing strains, which attain a height of 300 centimetres or more, are more productive than the dwarf types, which are not recommended therefore for field culture.

The *Louisiana Planter*, May 4, 1918, says that the cultivation and canning of pine-apples is the second leading industry of the Hawaiian Islands—second only to the sugar industry—and that it is rapidly increasing in importance. In 1917 the islands produced approximately 2,600,000 cases of the canned fruit, and the estimated output for 1918 is approximately 3,000,000 cases. About one-half of the winter output has been taken over by the United States Government, which is to use canned pine-apples as a portion of its soldiers' rations.

In a note on Jerusalem artichokes, the *Journal of the Board of Agriculture*, April 1918, states that recent investigations show that this vegetable is an excellent human food, and moreover yields large crops. An average yield from field cultivation is about 10 to 12 tons per acre. Another advantage possessed by the Jerusalem artichoke is that it is not subject to disease, and will grow in almost any soil and situation, though it succeeds best on a friable, sandy loam. It may be mentioned that this tuber can be successfully cultivated under West Indian conditions.

Mr. B. A. Malcolmson, the Honorary Secretary of the Agricultural Section of the British Empire's Producers' Organization, writes from Evelyn House, 62, Oxford Street, London, W.I., to draw attention to the fact that, owing chiefly to sentiment and custom, the British Friesian Society are likely to eliminate from their register all 'dun' Friesian cattle only allowing the registration of black and white, and black bulls. In tropical countries 'dun' is a good colour for cattle, and there are in England some of the finest Friesians of that colour, heavy milkers, and all pedigree stock. These could be secured on much more favourable terms for export than if they were black, or black and white.

The low grade of cotton produced in India has long been a subject of remark. *The Times Trade Supplement*, April 1918, says that Lancashire interests should note the declaration of Mr. Gammie, the cotton specialist, appointed some time back by the Government of India, that since the low grade varieties are profitable for the ryot, they will continue to be produced until buyers are willing to pay a bigger price for the longer stapled sorts. If the prices offered encourage the Indian cultivators to do so, they would willingly take up the finer sorts, which, after all, are just as easy to grow as the coarser varieties.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. Mr. W. N. Sands, the Agricultural Superintendent, describes operations of a routine nature both in the Experiment Stations and Botanic Gardens during the month of May. He states that land throughout the island was being prepared for planting in cotton and other crops. The cotton planted has germinated well. About 3 tons of selected cotton seed was distributed from the Ginnery for planting purposes. Exports of various food products and of stock were made to the neighbouring colonies. Owing to the efforts made, the position in regard to local foodstuffs was most reassuring. A gas-tight store for dry food products has been erected at the Ginnery. The destruction of food plants of the cotton stainer, including the Tobago Bread-nut tree (*Pachira aquatica*) and bois flot (*Ochroma lagopus*), is being continued. The Barbados blackbird, or 'Bequia sweet' (*Quiscalus fortirostris*) has been placed on the list of locally protected birds.

The Agricultural Superintendent, by notice and otherwise, made known to cotton growers throughout the island the fact that the local Government would purchase all the Sea Island cotton of the 1918-19 crop on behalf of the Admiralty, at the same prices as were paid last season. It is hoped that not less than 4,000 acres of Sea Island cotton, will be planted. Cotton growers in Bequia are said to have been much depressed by the failure of the crop last season, but the campaign against the food-plants of the cotton stainer, and the careful destruction of all cotton stalks have reassured them and also served as a useful and instructive object-lesson.

ST. LUCIA. Work in the Experiment Station and Botanic Gardens during the month of April was of a routine character, and included the making of farine and sweet potato flour, and planting cassava and potatoes. Plant distribution included 100 lime seedlings, 19 budded oranges, 2 ornamental plants, and 148 packets of vegetable seeds. The reaping of cacao and sugar-cane was in progress, while the lime trees were flowering, and land was being cleared for an extension of lime cultivation. The rainfall recorded for the month was: Botanic Gardens, Castries, 1·41 inches; Agricultural and Botanic Station, Choiseul, 1·45 inches.

During the month of May a continuation of operations commenced in April is reported by the Agricultural Superintendent. Plant distribution comprised: limes, 950; cacao, 100; banana and plantain suckers, 60; grafted mangoes, 6; ornamental plants, 50; vegetable seeds, 160 packets; Gliricidia cuttings, 25; ornamental cuttings, 6. The cacao and cane crops were practically over; limes continued flowering, and preparation for an extension of lime cultivation was in progress. The rainfall for the month was as follows: Botanic Gardens, Castries, 12·36 inches; Agricultural and Botanic Station, Choiseul, 6·24 inches.

DOMINICA. Both in the Experiment Stations and in the Botanic Garden necessary cultural operations were carried out during the month of May. Plant distribution included: limes, 775; budded citrus, 47; grafted mangoes, 3; coffee, 50; and miscellaneous, 112. In addition, 20 lb. of horse beans, and 240 packets of vegetable seeds were sold. The rainfall for the month was 5·90 inches.

MONTSERRAT. The weather during the month of May was unfavourable for planting operations in the Experiment Stations. Plant distribution included the following: Bay plants, 875; lime seedlings, 1,150; potato cuttings, 2,500; cassava cuttings, 1,125; black-eye peas, 11 lb.; pigeon peas, 3 lb. In the Botanic Station self-fertilization of cotton flowers on the breeding plot was commenced; four distillations of bay leaves were made with good results; a distillation of growth of the ajowan plant was made, and the resulting oil sent to Antigua for examination.

Regarding staple crops, Mr. Robson states that the major portion of the cotton crop has been planted, although the weather has not been favourable for germination, and many fields are irregular. The area planted early in March is suffering from want of rain, and the outlook for the crop at the moment is not bright. On certain areas planted in cotton, much trouble is being experienced with devil's grass (*Cynodon dactylon*). Excepting the loss of seedlings through attacks of the caterpillar of *Prodenia* sp., which is not very general or severe, there will be little trouble, Mr. Robson says, in getting the crop established, provided the weather continues favourable. An incipient form of root disease is often noticed, associated with seedlings growing under unfavourable conditions. Observations have been continued on the question of the association of silk-cotton trees and cotton stainers, and judging from the general prevalence of the insects, this may prove to be a season in which the cotton stainer may be regarded as being more abundant than usual. Considerable interest is being shown in the planting of bread-and-cheese hedges, a fair supply of seeds now being available. The rainfall recorded at Grove Station was 3·01 inches; the total precipitation for the year to date is 18·20 inches.

NEVIS. Welcome showers fell during the early part of May, which enabled the various plots in the Experiment Station to be planted. The following plants, seeds, etc., were distributed: 108 bags sweet potato cuttings, 707 lb. cotton seed, 12 lb. black-eye peas, 12½ lb. Para peas, 5,100 cassava cuttings, and 1 lb. of seed corn. Reaping of the old cane crop has been completed. Cotton planting throughout the island was in full progress during the month. The germination, on the whole, is very good, and the fields have all made a good stand. Over 2,000 acres are already planted, and it is estimated that no less that 3,000 acres will be put under cultivation in Nevis this season. A large acreage of provision crops was planted during the month, and the position, says the Agricultural Instructor, Mr. Howell, is now much more satisfactory. The rainfall for the month was 6·14 inches; for the year to date, 16·93 inches.

BARBUDA. Notes on items of interest concerning the Antigua Government estate of Barbuda for the months of January and February, by the Agricultural Instructor, Mr C. A. Gomes, have now come to hand. As a result of the protracted drought which prevailed, the reaping of the first crop of cotton was completed in January, the total yield being 29 bales, weighing 7,157 lb. of lint. The scarcity of fodder caused by the drought seriously affected the live stock, and there were a few deaths among young horses, older mares, and cows. Very high northerly winds prevailed throughout the two months. According to the records, February was the sixth month of continuous drought, which has resulted in the complete cessation of all agricultural activities. A continuation of this state of affairs much longer, says Mr. Gomes, will mean disaster to all crops and live stock on the island. In January 1·15, and in February 2·05 inches of rain were registered.

PLANT DISEASES.

EEL-WORM DISEASE (BLACKHEAD) OF BANANAS.

A serious affection of the coarse banana known in Grenada as the bluggoe, is reported from that island by the Superintendent of Agriculture. It is described by Mr. Moore as follows:—

'It appears that the disease may develop in plants of all ages, though its presence is most evident to the casual observer in plants that are approaching or have actually reached a fruiting stage.

'A common characteristic is the drying of the outer leaves and then of the partly developed bunch, the fruits of which often dry to a hard blackened condition when only 2 or 3 inches long.

'Plants examined do not show signs of disease in the parts most distant from the bulb and roots, the general impression conveyed by a survey of the affected plants being that they are suffering from lack of water and nourishment.

'In every instance, examination of the bulb and roots revealed a root system almost entirely dead, or partly dead and dying. The dead roots were either entirely black, or black between the cortex and the central column. The outer part of the bulb from which the roots arose presented the same black disorganized appearance, and this was repeated to a lesser degree on the bulbs and roots of young suckers arising from the diseased parent.'

Several hundred clumps have already been seen with the symptoms of this disease. The following notes refer to the conditions under which it occurs in three distinct localities.

A. About 300-400 stools of bluggoes planted with material from various sources two years ago; a crop of cane recently reaped from the land; young cacao plants set to each stool. Two types of soil, one black and heavy, one brown and loose; disease occurs on both. Trouble observed ever since plants reached maturity.

B. A field of several acres of limes interplanted last year with bluggoes, now fruiting for the first time. A view of the whole field conveys the impression that all the outer leaves of the bluggoe plants have been scorched. The dying commences along the margins of the leaf-blades.

C. Isolated clumps among mature cacao affected. The external symptoms, and the condition of the roots and bulbs are the same in all three cases.

Spirit-preserved material from the first two localities was forwarded by Mr. Moore for examination. Slices of the diseased bulb' show peripheral blackening penetrating to a depth of about an inch in places, and blackened areas isolated in section but connecting with the exterior at a higher or lower point. The thick roots have short vertical cracks, connecting with extensive discoloured patches spreading upwards and downwards in the tissue of the cortex, reaching in many cases to the central vascular cylinder but not penetrating it. The discoloured tissue is in various stages of disorganization, but in much of it the cell walls were not visibly decayed.

The affection has the general appearance of a fungoid disease, but neither hyphae nor bacteria were present to an extent or with a uniformity suggesting more than a saprophytic rôle. On the other hand, nematodes (eel-worms) were regularly present in all the material examined; their eggs were present in the least altered and deepest seated of the discoloured tissue, and in some cases the worms themselves were seen occupying the cells of undecayed tissue close to the central cylinder of the roots.

Reference to literature shows that N. A. Cobb (*Journal of Agricultural Research*, Washington, Vol. IV, pp. 561-8) has described an eel-worm, *Tylenchus similis*, as the cause of a serious outbreak of a disease of bananas in Fiji in 1890-91 and has found the same species attacking sugar-cane in Hawaii. S. F. Ashby (*Bulletin of the Department of Agriculture*, Jamaica, Vol. II, p. 316) describes a type of so-called blackhead disease in Jamaica, which he attributes to an eel-worm (identified later by Dr. Cobb as *Tylenchus similis*). The description of the condition of the roots and bulbs agrees in general with that given above.

From the nature of the infestation—minute worms living and laying eggs deeply within the tissues, capable of living in the surrounding soil, probably, as is the case with related species, resisting drying for months or years, infesting suckers on diseased plants from their earliest inception, possibly living on other species of plants—it will be seen that control may present difficult problems.

The first essential must be complete avoidance of the use of suckers from affected clumps as planting material. Where land is badly infested some other crop should be substituted. Direct treatment appears quite impossible. Ashby (loc. cit.) remarks regarding the Jamaica disease: 'The worms are widely present in cultivated soils, and even the roots of vigorous plants may show slight signs of attack. Unfavourable weather and soil conditions by checking active root growth and forcing the plant to depend on the older roots bring eel-worm injury into prominence, and make later recovery more uncertain.' Observations will no doubt be made as to whether more intensive cultivation will enable plants to 'grow away' from the disease in Grenada.

Further information is being sought as to the disease, and specimens of the nematode found have been submitted to Dr. Cobb for the favour of identification.

W. N.

DEMAND FOR LIGHT WOOD.

The Imperial Commissioner of Agriculture for the West Indies has been informed that there is at present a demand, arising out of the conditions of ocean transport, for very light woods, suited to the purpose of making rafts and equipment that will readily float.

There are growing in these West Indies several trees, the wood of which is of very low specific gravity. Among these is *Ochroma lagopus*, known in some of these islands as cork-wood, on account of the lightness of its wood; in others as down-tree, because of the silky fibres which envelop its seed; and in other islands, as bois flot. According to Cook and Collins in their book *Economic Plants of Porto Rico*, the wood of this tree is very porous, and is the lightest of all woods, lighter even than true cork, the specific gravity of which is 0·240, while the specific gravity of this wood is only 0·120. The tree is fairly abundant in the damper islands of the West Indies, and according to Mr. Eugene Campbell, in a note contributed to the *Agricultural News* for August 10, 1907, the down-tree is found growing plentifully along the banks of all the principal rivers in British Honduras. The trunks are used there for making rafts for floating logwood down the rivers. Some of the trees attain large dimensions, being 30 or 40 feet high and over 2 feet in diameter. In the West Indian islands, from Trinidad to Porto Rico, wherever the tree grows, the wood is used instead of cork by fishermen to make floats for their nets. The

fibre enveloping the seeds is used for the same purpose of stuffing pillows and mattresses as the fibre of the silk-cotton tree (*Eriodendron anfractuosum*), which is the kapok of commerce.

In some of the drier islands, such as Antigua, where, so far as the writer of this note knows, the cork tree does not grow, the wood of another tree is used by fishermen for the same purpose. This tree is the swamp or monkey apple (*Anona palustris*). It is a small tree seldom growing more than 20 feet high, the trunk being from 10 to 12 inches in diameter. The wood is very light and soft, and is said to be used in Porto Rico for making rafts. Cook and Collins give the specific gravity of the roots as 0·175. Besides being used for the making of floats for fishing nets, the wood is sometimes employed for sharpening razors.

Although not nearly as light as the wood of the two trees above mentioned, the silk-cotton tree affords a very soft and light wood which is said to be rather strong, and to resist water moderately well. It is stated that canoes are sometimes made from the enormous trunks or huge branches of this tree, but that such canoes are not very durable.

Another common tree of the West Indies is *Bursera gummifera*, the turpentine tree, or gommier rouge of the French islands. It grows to a considerable size, and seems especially to like limestone districts. The wood of this tree is also very soft and light, and is also said to be used for making canoes.

Two species of Spondias, the golden apple (*S. dulcis*) and the hog plum (*S. lutea*) are common throughout the West Indies. The trees of both of these species attain a considerable size in height and diameter of trunk. The wood of both of them is also light and soft, but is not used for any purpose, as far as the writer of this note knows.

The breadfruit tree (*Artocarpus incisa*) also furnishes a yellowish-grey wood rather light and soft, but strong, resistant, and elastic. These trees are, however, altogether too valuable as food producers to be cut down to supply any large quantity of timber.

The obtaining of any large amount of a given kind of timber from West Indian forests is a matter of difficulty, owing to the fact that there is very seldom a collection of the same species growing together in one neighbourhood. Such trees, however, as the cork wood and the monkey apple are found more or less in groups along the banks of rivulets, in the case of the cork tree; or in swampy land, in the case of the monkey apple.

The possibility of the employment of the huge flower-stalks of the various species of Agave for the construction of rafts may be noticed in connexion with the use of very light woods. These flower-stalks are regularly used for this purpose by the fisher folk in some parts of Antigua. In several islands it would be possible without much difficulty to collect large numbers of these.

THE BEHAVIOUR OF SWEET POTATOES IN THE GROUND.

In some investigations on the behaviour of sweet potatoes in storage by Messrs. Hasselbring and Hawkins, of the Bureau of Plant Industry, United States Department of Agriculture, recorded in the *Journal of Agricultural Research*, Vol. III. p. 331, and noticed in the *Agricultural News*, Vol. XIV, p. 140, it was observed that the percentage of starch was always highest, and the percentage of sugar lowest, in freshly dug potatoes. The constancy of the condition seemed to justify the conclusion that, in the growing sweet potato the reserved material exists essentially in the form of starch, and that the appearance of sugar in considerable quantities occurs only in storage, or after the destruction of the leaves.

In order to determine whether these quantitative relations between the starch content and the sugar content of the sweet potato remain constant throughout the latter part of the growing season, and to what extent they are changed by the death of the vines, Mr. Hasselbring conducted a further series of experiments on sweet potato roots from the time they were large enough to furnish the requisite samples, until they were seriously damaged by frost. The results of these experiments are recorded in the *Journal of Agricultural Research*, Vol. XII, No. 1.

This record of the condition of sweet potatoes during the period of growth may be useful as an aid in determining the time for harvesting the crop. Mr. Hasselbring advises growers, as a rule, to dig sweet potatoes when they are fully matured, or after they have thoroughly ripened. While it is implied that the roots reach a more or less definite stage of ripeness, the characteristics by which this state may be recognized are not precisely defined.

After giving detailed descriptions and tables of analyses made after various periods of growth of the root, Mr. Hasselbring comes to the conclusion that the changes occurring in sweet potatoes in the ground during the latter part of the growing season proceed in a regular and orderly manner. During the latter part of the period of growth the composition of the roots remains remarkably uniform, and presents no striking on irregular fluctuations. During this period the root is characterized by a high starch content and a low sugar content. The changes which occur later are associated with the death of the vines. Prominent among these changes is the accumulation of water in the roots as a result of the cessation of transpiration, in consequence of the destruction of the leaves. With the termination of the flow of materials from the vines, the carbohydrate transformations characteristic of sweet potatoes in storage are inaugurated. These changes consist in the transformation of starch into sugars. Appreciable destruction of carbohydrates does not appear to occur in potatoes in the ground until after the roots have been injured by frosts.

The changes here spoken of have a practical bearing on the question of maturation of sweet potatoes, and the best period of harvesting them. Since the carbohydrate relation of the roots in the ground remains practically unchanged while the vines are uninjured, the roots cannot be said to undergo a definite process of ripening, in the sense of a progressive transformation of one reserve substance into another, such as the change of starch into cane sugar and invert sugar in the ripening apple. Under ordinary conditions sweet potatoes continue to grow, without reaching any definite state of maturity recognizable by progressive change in the reserve material which they contain. The choice of time of harvest, therefore, is not a matter of maturity of the roots, but is governed by other factors. In the United States sweet potatoes may safely be kept in the ground until the leaves have been injured by frost.

Of the changes which occur after the destruction of the leaves, the accumulation of water in the roots deserves consideration. It can scarcely be doubted that this increased water content is detrimental to the successful storage of the roots, and causes them to be more subject to decay than roots of normal water content. On this account it is of utmost importance that the harvesting of sweet potatoes be not long delayed after the leaves have been killed.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, May 2.

ARROWROOT—No quotations.
BALATA—Venezuelan Block, 3/4½; Sheet, 3/11 to 4/2.
BEESWAX—No quotations.
CACAO—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 2/6 to 3/3.; concentrated, no quotations; Otto of lime (hand-pressed), 16/6.
LOGWOOD—No quotations.
MACE—2/5 to 3/6.
NUTMEGS—1/10 to 2/4.
PIMENTO—No quotations.
RUBBER—Para, fine hard, 2/1½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., May 27.

CACAO—Venezuelan, $11·50 to $11·75; Trinidad, $11·25 to $11·75.
COCO-NUT OIL—$1·51 per gallon.
COFFEE—Venezuelan, 12c. to 13c. per lb.
COPRA—$6·80 per 100 lb.
DHAL—$13·75 to $14·00.
ONIONS—$3·25 per 100 lb.
PEAS, SPLIT—$11·00 per bag.
POTATOES—English, $3·00 per 100 lb.
RICE—Yellow, $13·75 to $14·00; White, 9·50 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS. & Co., May 17.

CACAO—Caracas, 12⅝c. to 13¾c.; Grenada, 13¼c. to 13½c.; Trinidad, 13½c. to 13¾c. Jamaica, 12c.
COCO-NUTS—Jamaica selects, $40·00; Trinidad selects, $38·00; culls, $19·00 to $20·00 per M.
COFFEE—Jamaica, 9¼c. to 10½c. per lb.
GINGER—15½c. to 19c. per lb.
GOAT SKINS—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per lb.
GRAPE FRUIT—Jamaica, $2·50 to $4·00 per box.
LIMES—Import prohibited.
MACE—38c. to 47c. per lb.
NUTMEGS—29c.
ORANGES—Import prohibited.
PIMENTO—7c. to 7¼c. per lb.
SUGAR—Centrifugals, 96°, 6·005c; Muscovados, 89°, 5·005c. Molasses, 89°, 4·948c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., May 30.

ARROWROOT—$12·00 per 100 lb.
CACAO—$12·50 to $13·00 per 100 lb.
COCO-NUTS—$36·00 husked nuts.
HAY—$2·90.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations; Patna, no quotations; Rangoor, no quotations.
SUGAR—Dark Crystals, $4·75.

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A FORTNIGHTLY REVIEW

OF THE

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Forestry in the West Indies.

THE question of the conservation of the remaining forests in the West Indian islands has been considered and legislated on more or less adequately in recent years. An article by Sir Francis Watts in the *West Indian Bulletin*, Vol. XIII, deals comprehensively with this aspect of the matter, and it is to be hoped that reckless denudation of forest areas in the West Indies is a thing of the past. Much useful work has been done also by the Agricultural Departments in the different islands in encouraging more extensive planting of trees both economical and ornamental.

Forestry may be defined as the art of managing forests regarded as crops, so as to make a rational use of them and to secure continuous supplies of the crop. If looked at from this standpoint, it is evident that very little, if anything, has been attempted in forestry in the West Indies, though an exception must be made of Trinidad, where in recent years some planting of forest trees has been begun on scientific lines.

Very many people seem to forget that the art of dealing with forest crops, as defined above, is just as much dependent on scientific attention to details in order to obtain really good results, as the art of dealing with any ordinary agricultural crop. As long as there are extensive virgin forests from which supplies of wood may be drawn, most people seem to think it unnecessary to bestow any care upon the methods of using them or of replacing them. Trees are cut wastefully, and their reproduction is left to chance and to nature's slow processes, although nature cannot be said to have any definite economic object to subserve. When, however, the forest area becomes more and more limited by the extension of the agricultural area, it becomes apparent that wood crops are as necessary as food crops, and the need of forestry is then realized.

Another aspect of the question demonstrates the need of forestry, namely, the influence of forest cover upon the soil and water conditions of neighbouring

agricultural lands, which is often rendered apparent by the reckless denudation of mountains and hillsides.

There are two questions involved in this aspect of the matter. First the effect of the forest cover on the conditions within its own boundary, and secondly, its effect on the conditions of the surrounding country.

The influence upon the conditions under its own cover which a forest exercises seems to be mainly due to the canopy of foliage interposed between the sun, the rain and the wind, and the soil. The exclusion of the sun and the wind reduces the evaporation, and therefore both the air and the soil under the shade of a forest are, as a rule, not only cooler, but moister than in an open field. Trees bring up the water also from greater depths, and transpire this water into the air, thus increasing its humidity in their neighbourhood.

It is true that it does not seem likely that an increase of rainfall in their neighbourhood can properly be attributed to the influence of forests, for other conditions producing rainfall are so much more powerful, that it is doubtful whether such a forest effect, even if it existed, would be appreciable.

The most important effect of forests upon water and soil conditions is a mechanical one. It must be remembered that agricultural crops depend chiefly on water supplied to their roots, whether furnished by rain directly, by artificial watering on the surface, or by a natural underground drainage, this latter being the ideal form of supply.

Now this is exactly what a forest covering aids in securing. A forest growth conserves moisture in the air above the soil, and by its deep-reaching root system assists the percolation of the falling rain, and permits the subdrainage of such water, at the same time preventing its wastage by surface evaporation. The waters falling on a well forested slope find lower levels underground, and furnish constant supplies to fields below them.

Considering forestry as the art of producing a crop, it must be remembered that the forest crop differs from all other crops in the fact that it takes such a long period to yield returns. There is no definite period when the crop can be said to be mature, as in the case of agricultural products. It consists of annual accumulations which are allowed to continue until the individual trees attain either a useful or a profitable size; and, to attain such size a long time, and, with different species and conditions, a variable time, is needed. Thus, for firewood production a growth of fifteen to twenty-five years might suffice, while for good lumber production not less than seventy-five to one hundred years and more are needed. In an average of a hundred years the yearly growth, according to species, soil, and climatic conditions, would vary between 30 and 180 cubic feet of wood per acre each year. But, unless firewood is the object of forest cropping, it is not quantity of wood merely, but wood of given size and of given quality, wood fit for the arts, that is to be grown.

With regard to the production of timber, there is a great drawback attaching to tropical forests in the fact that, although such forests contain valuable woods, these woods are seldom found in groups of trees of the same species in any considerable number. One object of scientific forestry in the improvement of already existing forests in these islands might well be the elimination of the less valuable kinds of trees, leaving those of more value, and the planting of seedlings of the kind desired in the room of the trees taken out. In this way, in course of time, existing forests would become more and more valuable as the source of timber supply.

But a still more practicable and profitable aim would seem to be the reafforestation of already denuded tracts of land, especially on hillsides, or on rocky or sandy soils unsuitable for growing ordinary crops. In this connexion the value of scientific forestry would certainly make itself felt. The mere planting of a few trees of one species this year, and perhaps next year the planting of a few more of possibly quite a different kind, and so on, although useful in a way, is not likely to obtain the production of any really valuable forest crop.

In the first place, the suitability of any species of tree, or the situation in which it is to be grown, ought to be determined, in order to avoid inevitable disappointments which arise from trying to grow any plant in an unsuitable environment. In the next place, it has been demonstrated in countries where forestry is successfully practised, especially in France and Germany, that afforestation is only really beneficial and profitable when considerable tracts of the area to be afforested are planted at one time with seedlings of the same age, in order that there may be a wood crop of sufficiently large proportions which would arrive at maturity at the same time.

In Trinidad it appears that a considerable extent of country is being now afforested in this way with the

red cedar (*Cedrela odorata.*) The example might well be followed in many places in some of these smaller islands, with the same tree or some other valuable wood, as for instance, in Antigua and the Virgin Islands. In an island like Barbados, which depends for firewood almost entirely on importations from other places, it would seem to offer a paying investment to replace on the not inconsiderable areas behind the beaches the present haphazard growth of manchineel, whitewood, and almond with regularly grown woods of Casuarina for instance, which would yield in from ten to fifteen years a valuable crop of firewood, continuing to do the same at intervals of two to three years for a long subsequent period.

THE CHROME-TANNING INDUSTRY.

In view of the interest which is at present displayed in the development of local tanneries in the West Indian islands, which has been noticed in recent issues of this Journal, the following extracts from an article in *The Board of Trade Journal*, May 9, 1918, may be of interest:—

Tanning by means of chromium compounds has been very much more extensively developed in Germany and the United States of America than in the United Kingdom. German and American manufacturers quickly realized the value of the new method and made such rapid progress in the practice of the various processes that they were able to sell in the United Kingdom at prices lower than the British cost of production, and by this means, to discourage the establishment of the industry here.

There was at that time no prejudice against using foreign goods at the expense of British manufacturers, and, since foreign chrome-tanned leather possessed certain obvious advantages, British boot manufacturers were ready to purchase it. It was unfortunate that the chrome process was not developed in the United Kingdom, because there is no doubt that it had become a serious factor in the deflection which occurred in the tannage of certain hides and skins from this country to our competitors in Germany and the United States of America. This movement of trade was most pronounced in respect of the hides and skins exported from India.

Before the war, India exported about 345,000 cwt. of raw hides per annum, of which the Central Empires took one-half, the United States of America one-third, and the remainder was divided between the United Kingdom, the Netherlands, and Italy. The position regarding raw goat and sheep skins was just as unsatisfactory to this country. The United States of America imported direct about 75 per cent. of the total export of raw goat skins of India, the United Kingdom 10 per cent., France 7 per cent., the Netherlands and Belgium 5 per cent., and Germany an insignificant quantity.

The position was not felt acutely here until the outbreak of war convulsed the world's markets, and made its effect felt in the raw-hide trades. The sudden demand for footwear for the armies of this country and her Allies made it essential that the normal tanning capacity of this country should be materially extended. At the same time fresh sources of raw materials had to be utilized, and once more attention was directed to the vast potentialities of the Indian Empire.

Up to the present the tanners of the United Kingdom have shown a distinct, even an overwhelming, preference for vegetable tannage, as distinguished from mineral, including chrome tannage. The fundamental principle in both vegetable and mineral tanning is the same. It may be thus expressed in the words of a distinguished tanning authority: 'It is not only necessary to dry the fibres in a separate and non adhesive condition, but so as to coat them or alter their chemical character that they are no longer capable of being swelled or rendered sticky by water'

The action of chromium salts, whether normal or basic, on hides was first studied by Knapp (*Die Natur und Wesen der Gerberei*, 1868). Knapp described a method of chrome tanning which is identical with one of the modern processes, for he proposed the formation of a basic chromium salt by the addition of some compound, such as normal sodium carbonate to the chrome solution after the manner of the so-called 'single-bath' process.

In 1884 a successful two-bath process was patented in the United States of America by August Schultz, and the process proved a commercial success in the production of light leathers. According to the Schultz process, the skins are impregnated with a solution of potassium bichromate, acidified with hydrochloric acid, and the chromic acid absorbed by the skins is subsequently reduced by means of sulphurous acid, through the immersion of the skins in an acidified solution of sodium thiosulphate.

One of the main advantages of chrome tanning is the rapidity of the process as compared with vegetable tannage, and the consequent increase in the possible turn over. The waterproofness and compactness of the leather after fat liquoring, etc., cause it to be sought after for box-calf, glacé kid, and other upper-leathers. The affinity for chrome tannage varies from leather to leather. Sheep skins, horse hides and kips show a smaller affinity for it than goat skins, ox-hides, and especially calf skins. The further property of the chromium salts of forming lakes with many mordant colouring matters makes their use for tanning skins of considerable interest where the production of coloured leathers is the object in view. The chrome tannage of skins entails closer technical supervision of processes than vegetable tannage: but the problems it offers the chemist and tanner, and the possibilities it affords of achieving all those results in leather production that have given the German and American tanners their advantages in the past, must necessarily appeal to progressive tanners and leather chemists of the United Kingdom.

DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture for the West Indies, Sir Francis Watts, K.C.M.G., has returned to Barbados from his visit to Jamaica and the Bahamas.

Mr. H. A. Ballou, O.N., M.Sc., has also returned to Barbados, on the completion of his work in Egypt.

SUGAR INDUSTRY.

THE SUGAR INDUSTRY AFTER THE WAR

A summary of a paper with the above title, read before the Royal Philosophical Society of Glasgow, by Mr. T. H. P. Heriot, Lecturer on Sugar Manufacture at the Royal Technical College, Glasgow, is given in the *International Sugar Journal*, April 1918.

The lecturer pointed out that foreign beet sugar had gained an ascendency in British markets which lasted until the outbreak of the present war. The bulk of the supplies having been then cut off, the British market was compelled to rely chiefly on neutrals, Cuba and Java. Our colonial industry has slightly increased its production during the war, but is seriously handicapped by shortage of labour, and the difficulty of obtaining supplies and machinery.

The future problem is to increase the production of sugar within the Empire, until we become independent of foreign supplies. As regards the three contributing factors —land, labour, and capital—the enquiry set on foot by the West India Committee leads to the conclusion that there is no scarcity of suitable land in the Empire. As regards labour, Indian indentured labour has long been employed in the British Crown Colonies, but the supply has been barely sufficient to meet past requirements, and has recently been entirely stopped. To attract this labour to our colonies we must offer more favourable terms than in the past, and reduce the period of indenture. Capital is required to set this labour to work, and to erect additional factories, and the only way to attract capital is to make the industry secure, and profitable to the investor.

Before the war the price of sugar was abnormally low, resulting in extravagance and waste; to-day sugar stands at least at $5\frac{1}{2}d.$ per lb. to consumers. After the war a reduction in price following on a larger supply is hoped for. Even assuming that the present high duty of $1\frac{1}{2}d.$ per lb. is maintained for some time after peace is declared, the retail price of British Empire sugar should not exceed $4d.$ per lb. If it received a preferential duty to the extent of 50 per cent. of the duty on foreign sugar, such British sugar might be retailed at $3\frac{1}{4}d.$ per lb.

A fourth factor of production is science, the function of which is to direct labour in its tasks. Sugar production is a highly complex business, requiring expert knowledge of various kinds. It is evident that it should be recruited from young men who have received, first of all, a good general scientific training, and subsequently a more special training in sugar technology to prepare them for the special duties they have in view. The old style of training was to plant a youth down in a factory, and let hard experience and many blunders be his instructors. Doubtless he learnt his business, but only slowly and superficially. The true method is to teach the student all essential principles by means of lectures and laboratory experiments outside the factory, so that when he enters the factory he understands what he sees, and hardly needs any other instructor than his own eyes and intelligence. He has then only to study on a large scale what he previously studied on a small one; and the more will he learn during his practical experience in the sugar factory.

Technical training is, however, only the first help towards rendering the sugar industry efficient. The second step is to provide more men and more funds for research, in order to solve the numerous problems which practical experience brings to light. Research must follow two directions, namely, the agricultural and the manufacturing branches of sugar production.

Problems relating to the cultivation of the sugar-cane must be studied in the tropics where the plant is grown. The special aims of agricultural research would include the production of improved varieties of sugar-cane raised from seed; the manurial requirements of the cane crop when cultivated on different soils; and the study of plant diseases and insect pests with a view to devising practical remedies. Indoor investigation would include the analyses of sugar-cane, soils, and fertilizers, and also the microscopical investigation of diseased plants, thus requiring chemical and biological laboratories adjacent to the experimental fields. It will be evident that such agricultural research stations should also afford every facility for training students in field operations under the supervision of experts, thereby combining practical training with scientific research.

The other branch of research relating to problems in the factory, cannot so well be carried on in the factory itself, without seriously interfering with the routine work. Experiments must begin on a small scale in the laboratory, the final or factory test being only possible after every detail is studied. It is proposed to utilize some of the technical laboratories in Great Britain for such investigations, but funds will be required to carry out this work. For this purpose a Sugar Research Association is now being formed by a committee of the British Empire Producers Organization, and when a fund has been subscribed the Government will contribute an equal sum.

Techinal training and research require the active support of those interested in the industry. Hitherto in the British Empire co-operation in this direction has been almost unknown, and research has been mainly carried on by Government chemists and botanists attached to the colonies, and free of all expense to the sugar-cane industry. But if we turn to the Hawaiian Islands we find there a research department initiated by and entirely maintained at the expense of the sugar-cane industry which it assists. The Hawaiians also carry co-operation on these lines still farther. There are separate associations of cane planters, factory engineers, and chemists, which meet periodically to discuss every phase of sugar production. There is also a central office or bureau which receives the weekly reports from all the factories, tabulates these records, and issues copies to every factory, so that the results from different factories may be compared week by week.

SUGAR AS A FOOD.

The value of sugar as a foodstuff for human beings has been frequently pointed out. An article in the *Louisiana Planter*, May 25, 1918, remarks that it was demonstrated twenty or more years ago that for athletic exercises, the quickest reliable stimulation is produced by the use of sugar, which stimulation is produced in less than an hour from the time the sugar is consumed. Sugar in fact seems to be in this respect at the head of the list of foodstuffs.

Pure cane sugar is the most easily digested of all foods, except levulose and dextrose, which are known as invert sugars. When taken into the system, cane sugar is promptly inverted by the secretions of the stomach into levulose and dextrose, and is then immediately assimilated. These invert sugars arise from the breaking up of cane sugar into dextrose and levulose, the one polarizing to the right and the other to the left. There is no other food which is capable of being assimilated without digestion in the stomach. These two sugars, formed at once in the stomach, are diluted by the stomachic juices, and are immediately absorbed in the

when administered to exhausted patients is not because of their alcoholic contents, but because of their invert sugars, which give immediate nutrition due to the quick assimilation of them by the system.

Although sugar has risen considerably in price, it is still probably the most economical of all popular foodstuffs for the purpose of conveying energy to the human system. It must of course be borne in mind that a certain amount of protein and other matters are essential to make up what is called a balanced ration, but nevertheless, as regards nutrition and bodily stimulation, sugar is the most quickly acting of any foodstuff known.

An increase in sugar consumed, when not too great, and when the sugar is not too concentrated, lessens or delays fatigue, and increases working power. It has been found that the taking of 3 or 4 oz. of sugar, a short time before the usual time for the occurrence of fatigue after labour, prevents the feeling of fatigue, the effect of the sugar being evident about half an hour after eating it.

THE SWEETEST PLANT KNOWN.

A well-known Paraguayan botanist, Dr. Moises S. Bertoni, in *Anales Cientificos Paraguayos*, January 1918, has published an interesting account of a plant which he has named *Stevia Rebaudiana*. This plant grows in the higher lands in the neighbourhood of San Pedro, Paraguay, although it is comparatively rare. It belongs to the order Compositae, and is closely related to the genus Eupatorium, several species of which occur in the West Indian islands.

It would appear that a chemical analysis of the leaves of this plant in 1899 first drew attention to the wonderful sweetening power which they possess. Further chemical investigation of the plant in the Official Laboratory of Hamburg in 1913 drew still further attention to this plant. The report of the last named authority states that the specimens received are of the plant which some years ago caused alarm to the producers of sugar. The sweet substance which the leaves contain is more or less 180 times sweeter than cane sugar. Two different sweet substances have been isolated from the leaves: eupatorin or estevin, and rebaudin, the latter being the tripotassic and sodic salt of the former. The crystallized substance, sweet in taste and red in colour, is probably a glucoside, and is contained in the leaves in conjunction with resins, tanic acid, wax, and a little oil, in the proportion of from 20 to 26 per cent. The sweet substance is not fermentable. It appears from the analyses made, that the plant has no equal with regard to the power of its saccharine contents, but it will not be likely to compete in its industrial application with the known classes of sugar, cane sugar, and beet root sugar, but will probably be limited to medical purposes, such as the preparation of saccharine for use in diabetic cases.

The importance of the product of this plant is chiefly in its quality as a substitute for saccharine. In this respect it presents the following great advantages over saccharine:—

(1) In not having any toxic effect, but being on the contrary wholesome, as has been shown by experience, and by the chemical examination of the plant made by Dr. Rebaudi, a chemist in honour of whom Dr. Bertoni gave it its specific name.

(2) In being a sweetening substance of greater power.

(3) In being capable of being employed just as it is found in its natural state, by using the leaves crushed to powder.

(4) In the fact that it can be put on the market at a much lower price than saccharine.

With regard to its possibilities under cultivation, Dr. Bertoni says that it can be easily cultivated, and might reasonably become an important article of production in Paraguay. Furthermore, a sure market would be open to the produce, seeing that from small samples remitted to Europe and North America a lively interest has been evoked, and requests have been made for the supply of many tons if possible.

The advantages which the plant possesses as a sugar for various medical purposes, the infermentability of the glucoside derived from it, its enormous sweetening power, from 150 to 180 times greater than that of sugar, the agreeable taste of syrups prepared with it, tend to show that there may possibly be a great future for the production of this plant.

It is true that the cultivation of it is attended with this drawback that the plants under cultivation have not given many fertile seeds, but its multiplication by cuttings, suckers, and division of the stalk, chiefly the latter, is comparatively easy.

In conclusion it is stated that its principal sweetening substance, which ought to be known by the name estevin rather than eupatorin, is a glucoside which it is not necessary to separate from its salt, rebaudin, and that for general medical and economic purposes the powdered leaf might well be employed. The sweetening power of the powdered leaf is forty to forty-five times superior to that of any other known natural substance, and it contains no other active principle or harmful substance. The bitter aromatic resin, shown by analysis to be contained in the leaves, has on the contrary a tonic action on the digestive organs. Another advantage which the leaves possess is that they may be preserved dry without deterioration for an indefinite period. If cuttings or seeds could be obtained, it might be interesting and perhaps profitable, to make trial of growing this plant in the West Indies.

A NEW INDUSTRY IN BRITISH HONDURAS.

The Cohune palm (*Attale Cohune*) is met with in nearly every part of Honduras. The nuts which it bears in large quantities, yield a fine edible oil, but the shell which covers the kernel is extremely thick and hard, and on account of the difficulty of breaking it but little use has been made of the nuts in the past.

Of late years considerable interest has been shown in the Cohune nuts, and at various times machines have been introduced to deal with them, but for one reason or another complete success has not been attained.

It appears from the British Honduras *Clarion*, May 30, 1918, that another venture is to be made, and this time these nuts are to be used in furtherance of the war.

The use of Cohune nuts in producing a material of the highest value in protecting the lives of the soldiers of the allied nations has recently assumed very great importance.

The United States Government requires large quantities of them, and has commissioned the Franklin Baker Company to organize a collecting and purchasing system.

Many discoveries have been made in the process of organizing war industries. One of the most unique of these is the high value possessed by charcoal made from the shell of the Cohune nut, which is produced in abundance from a variety of palm common to the forests of British Honduras. This charcoal is extremely efficacious in neutralizing the effect of gas attacks.

THE WORLD'S PRODUCTION OF FERTILIZERS AND CHEMICALS EMPLOYED IN AGRICULTURE.

Important data contained in an interesting review covering detailed enquiry into the above subject, recently published by the International Institute of Agriculture at Rome, are summarized in the *International Sugar Journal*, May 1918. In view of the growing scarcity of labour occasioned by the prolonged war, the problem of the use of fertilizers as an aid to agriculture has become a prominent one, and there is need for increased fertility in the different countries which are now forced more than ever to resort to their own agriculture to produce their food requirements. For this purpose the use of fertilizers is one of prime importance, and the summary of data concerning known sources and quantities of the world's present production is of interest.

NATURAL PHOSPHATES.

Natural phosphates are a production confined mainly to the United States and the north of Africa. In the former, the sales in 1916 amounted to 2,014,196 tons; Tunis in the same year supplied 1,695,000 tons, while smaller amounts were yielded by Egypt and Algeria. Makers of fertilizers claim that the price of phosphatic fertilizers should show a much greater increase than that of the rough phosphate, the rise being necessary to meet the enhanced price of the sulphuric acid required in the preparation of fertilizers. It is anticipated that the improvement in the manufactured quantities of natural phosphates, manifest in 1916, will have continued during 1917.

BASIC SLAG.

The production of Germany in the first ten months of 1916 was 1,592,000 tons as compared with 2,500 in 1913. The production of this commodity has also decreased considerably in all other countries, as will be seen from the following summary:—

Superphosphate of lime.	1916.	1915.	1914.	1913.
	Thousands of metric tons.			
Spain	315	194	220	225
France	350	600	1,600	1,920
Great Britain	—	685	—	820
Italy	848	913	906	972
United States	—	2,533	3,785	2,348

POTASH SALTS.

The German distribution department for production of potash fixed the following aggregate for the year 1917:—

Germany, 762,250 tons: other countries, 155,000 tons; total, 911,450 tons of pure potash.

Deliveries of German potash salts in 1916 reached a total of 883,696 tons of pure potash, as against 680,005 tons in 1915, 903,988 in 1914, and 1,110,370 tons in 1913.

The production of potash salts in the United States in 1916 was estimated at 32,422 metric tons of products with an average of about 7 per cent. of potash, representing a production of potash amounting to 8,818 tons. This is very nearly ten times the production of 1915, but no more than one-twentieth the normal consumption of potash in the United States.

NITRATE OF SODA.

The production of the Chilean nitrate beds in the first half of 1917 was very nearly equal to that of the corresponding period in 1916, being 1,482,122 metric tons in 1917, and 1,488,792 in 1916. In the first half of 1915 a minimum was established on a production of about 600,000 tons. The stocks on the Chilean coast on June 30 have never been so large as those in 1917: they amounted to 936,235, while they were 919,102 tons at the same date in 1916, about 850,000 tons in 1915, and 775,000 tons in 1914. The reason for this abnormal increase of stocks must be sought, it is stated, in the fact that, while production totals show little change, the shipments to European and American ports have been much hampered by the lack of tonnage, and by the consequent enhancement of freight rates. These shipments represent, during the first half of 1917, a total of 1,230,947 tons, as against 1,356,629 tons in 1916, say, 125,082 tons less than 1917.

SULPHATE OF AMMONIA.

A production of 700,000 tons of sulphate of ammonia was expected in Germany for 1916, while, according to the most recent available data, the quantity for 1915 was 549,000 tons.

Owing to the enormous demand for steel, both for European countries and American foundries, the production of sulphate in the United States has greatly increased since 1914. In 1916 the production of ammonia, reckoned in sulphate, was about 294,838 metric tons, or 47·7 per cent. more than in 1915. The increase is still clearer when the data are compared with those of 1914, when the production was only 166,016 tons.

For 1917 the American production of ammonia was estimated at 400,000 tons, reckoned in sulphate: and the capacity for production in 1918, it is stated, may reach at least 500,000 tons.

The Japanese production of sulphate of ammonia is also continuously increasing. For 1917 the estimate was 50,802 tons, and some people predict a total of 60,000 tons. This increased production is said to be due to the same causes that have influenced the output in America.

The subjoined table summarizes the information published by the Institute of Agriculture with respect to the production of sulphate of ammonia from 1914 to 1916:—

Sulphate of ammonia.	1916.	1915.	1914.
	Thousands of metric tons.		
Spain	18	16	16
France	25	42	—
United Kingdom	445	433	433
Netherlands	4	5	5
Russia	33	16	17
United States	295	227	166
Japan	38	32	16
Australia	7	7	6

CYANAMIDE OF CALCIUM.

Cyanamide of calcium was, previous to the war, chiefly produced in the United States and Canada, Norway, Sweden, Germany and Austria-Hungary. As compared with 1914, Germany in 1916 had raised her production from 24,000 to 500,000 tons, Norway and Sweden from 40,000 to 220,000 tons, while the North American production was only increased from 48,000 to 60,000 tons. These figures are, however, only estimates. France from producing only 7,000 tons in 1913 obtained about 100,000 in 1916. The American consular reports consider that, besides this production of cyanamide, Germany would recover in 1917 nearly 500,000 tons of ammonia by the aid of the Haber process, which represents, for that country alone, a total of nitrates extracted from the atmosphere, equal to 200,000 tons. If to this are added the 140,000 tons of nitrates represented by the 700,000 tons of sulphate of ammonia expected in 1917 for

that country, we find for Germany an available aggregate of 340,000 tons of nitrate, if the production of cyanamide in 1917 is estimated as equal to those of 1916 and 1915.

SULPHUR.

The Italian production of raw sulphur during the first half of 1917 was officially estimated at 100,240 metric tons, as against 269,374 and 558,107 tons, respectively, for the complete years 1916 and 1915. Almost the whole of the sulphur produced in the United States at present comes from deposits in Louisiana and Texas, but deposits that might have been or might be productive are known in Wyoming, Nevada, Utah, California, Colorada, Oregon, and Alaska. Some authorities on the question reckon that the United States have consumed about 900,000 tons in 1915 and 1916, as compared with 300,000 in 1913. It is expected that the demand in the States will have attained 1,200,000 in 1917, and may probably grow to 1,600,000 in 1918.

The only other large producer is Japan, which had an output of 61,000 tons in 1915, and 93,000 tons in 1916.

SULPHATE OF COPPER.

Subjoined are the items of information published by the Institute:—

Sulphate of copper.	1916.	1915.	1914.	1913.
	Thousands of metric tons.			
Spain	8	1	0	0
France	27	16	21	26
Great Britain	39	66	60	77
Italy	48	41	31	44
United States	6*	19	14	25

* Production of the *American Smelting and Refining Company* only.

From a summary of wholesale prices for fertilizers, we find that the average prices for the first half of 1917, per long ton, were as follows:—

Sulphate of potash (London), £66.

Nitrate of soda (Liverpool), £23.

Sulphate of ammonia (Hull), £19. 10*s.*; (New York), £24.

Raw sulphur (Sicily), £8 3*s.* 4*d.*; (London), £14 8*s.*

Sulphate of copper (London), £63 7*s.* 6*d.*; (New York), £48 10*s.*

LIMA BEANS.

Wherever agriculture is practised, either in tropical or temperate countries, some kind of leguminous crop is grown. The seeds of such crops come next in importance to cereals. Among the most widely grown of these are the many varieties of *Phaseolus lunatus*, known as Lima beans, or butter beans, or white beans, and sometimes even as haricot beans, although this name properly belongs to the seeds of *Phaseolus vulgaris*.

The seeds of the white or Lima bean vary considerably in appearance, but they are usually flattened more or less, kidney-shaped in profile, and from deep purple to red-brown or white in colour. All the varieties of the seed show lines radiating from the hilum to the outer edge, usually strongly marked in coloured forms, but only appearing as faint lines in the white varieties.

A native of South America, *Phaseolus lunatus* is now widely distributed in cultivation throughout the warmer parts of the world. Under cultivation the size of the seed has been much increased, and the colour has been changed in many varieties from purplish red to white.

The importation of these beans into the United Kingdom, as stated in an article on the Peas and Beans of Commerce in the *Bulletin of the Imperial Institute*, October-December 1917, amounted in 1916 to no less than 1,077,600 cwt., of the value of £1,239,325. Of this total, 801,670 cwt. were imported from countries within the British Empire, chiefly from Burma. The largest importation from foreign countries was from Madagascar, to the amount of 138,570 cwt.

In Madagascar the bean is said to receive but little cultivation. Holes are made in the soft ground in which two or three seeds are planted, but during the period of about six months which the crop requires to ripen its seeds, the plant receives no attention. The long twining stems are simply allowed to trail over the ground. The harvesting is done by hand, the ripe pods being plucked and thrown together in heaps, and afterwards thrashed with a flail to obtain the beans. These Madagascar beans are of large size, flat, and kidney-shaped, and of an ivory white colour.

The two most common forms known in Burma are the red-seeded and the white-seeded kinds, the latter being known as Rangoon beans, which are, however, much smaller than the Madagascar butter bean. In Burma no less than 240,000 acres were devoted to the cultivation of the white variety, and 94,000 to the red in 1916-17. There the seeds are usually dropped into furrows in rows of about 1 foot to a foot and a half apart; they are also sometimes sown along with maize. When sown with maize the stems of the maize plant serve as supports to the trailing stems of the beans, but when sown alone the stems are allowed to trail over the ground.

The development of hydrocyanic acid in the beans of *Phaseolus lunatus* has been studied at the Imperial Institute for several years. In the first instance, beans produced in Mauritius by wild plants were examined, and were found to yield 0·1 per cent. of hydrocyanic acid. Soon after, when large quantities of Burma beans began to be placed on the British market, samples of these were examined, and found to yield only traces of hydrocyanic acid which were too small to be harmful.

In 1905, beans derived from wild plants of *P. lunatus* appeared on the market under the name of Java beans, and these caused the death of a number of cattle in England, as well as of some human beings on the Continent. Samples of these beans were also examined at the Imperial Institute, and were found to furnish quantities of hydrocyanic acid varying from 0·03 to 0·16 per cent.

There is a great difference in the poisonous properties of beans produced in Java and Mauritius by wild plants of the species, and of those produced in Burma or elsewhere from the cultivated varieties. Both the white and the red form of Burma beans have been repeatedly examined. As a rule, the white beans yield no prussic acid, though sometimes traces are present. The red beans usually yield traces, but in no cases have quantities of prussic acid which can be regarded as harmful been found at the Imperial Institute in Burma beans of either type.

White cultivated types of *P. lunatus* from South Africa and Madagascar have also been examined, and found to yield no hydrocyanic acid, or only mere traces. It is evident therefore, that the beans derived from cultivated forms of *P. lunatus* which are obtained from Madagascar, South America, and Burma, and probably also those produced in the United States and Southern Europe, rarely, if ever, yield hydrocyanic acid in quantities likely to be injurious, but at the same time it is advisable that if the cultivation of any varieties of this species be extensively undertaken on new areas, the product should be examined before being placed on the market as an article for human consumption.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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Mycologist	W. Nowell, D.I.C.
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†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial draws attention to the advantage which more scientific forestry would confer on these islands.

Under Insect Notes, on page 218, an article will be found on the substitution of starch for lime in arsenical mixtures for insect control.

On page 213 there appears an article describing the wonderful sweet content of a Paraguayan plant.

Figures showing the total production in the world of agricultural artificial fertilizers are presented in an article on page 214.

A Seaweed Substitute for Cotton.

According to a note in *The Board of Trade Journal*, May 16, 1918, an interesting account of a substitute for cotton in Japan has been published in a recent issue of the Japan *Advertiser*. The discovery of the substitute, which is said to be a good one, was reported to the Japanese Federation of Marine Industry Associations by the Vice-President of the House of Representatives. Seaweeds called 'sugamo' and 'gomo-gomo' form the raw materials from which the cotton substitute is extracted. These weeds are found in abundance in the seas around Japan, and have been chiefly utilized hitherto as good fertilizing material.

The process of manufacture is stated to be comparatively simple. The weed is boiled in water to which ashes have been added, and then in water mixed with rice bran. When it is thoroughly boiled it is then bleached. This is stated to be all that is necessary to produce good fibres. It is also said that the Tokio Fibre Laboratory, where the discovery was made, has taken out a patent for the process, and it is estimated that an annual production of about 826,700,000 lb. can be attained.

A New Food Mammal.

Referring to the article under this heading in the *Agricultural News* of April 20, 1918, Mr. Joseph Sturge, of Birmingham, contributes the following interesting note: 'I expect you have seen, as I have, the manatee swimming about in the lake in the Botanical Garden at Georgetown, Demerara, but probably you have not heard of an interesting use for the creature. Mr. Wrigglesworth, of the Demerara Railway, told me that he had two long wayside tanks to provide the locomotives with water. These constantly needed freeing from grass growth, which encumbered them. He bought a young manatee, and put him into one of the tanks; in a month he had absolutely freed the tank from grass. He then had the manatee caught in a strong net, and taken to the other tank, which he cleaned out in like manner. The creature filled this useful office for years, until it had grown 9 feet long, when it escaped in a time of flood. When there was no grass left in the tank the manatee would come to the watchman for its food.'

The Home Vegetable Garden.

In another column in the present issue of this Journal is reproduced from *Farmers' Bulletin, 818*, of the United States Department of Agriculture, interesting and useful advice on the management of small vegetable gardens. As supplementing the advice there given, it may be worth while to add the following admonition published in the *Journal of the New York Botanical Garden*, April 18, 1918, on the subject of the 'home vegetable garden.' It is stated there that one of the strongest national appeals this year for the home food garden is to save transportation space. Cargo for all

carriers is far in excess of the means to move it, and war material has the first call. Whatever each of us can do to relieve the situation is a real help. More than ever we must use good judgment in our gardens, and never was there more inspiration to do our best. Seeds, fertilizers, and labour are scarce. Let us show our patriotism by using these to the best advantage. Let us have the best gardens we can with the least waste of any of these precious items. Buy the best grades of seeds, and only as much as is needed. Plant these seeds carefully, with special attention to spacing in the rows, and between the rows, so that there will be less thinning this year than usual. Let us plant or transplant this year into gardens that have the soil better prepared than ever before, deeply dug, free from weeds, well cultivated. Let novices grow what is reasonably sure of success, and leave to the experienced growers the special, the difficult, and the field crops.

Green foods are especially valuable in the dietary, and the fresher they are, the more valuable they are. Only from the home garden can they be gathered just at the right stage of development, and a few minutes before using.

The war is rapidly teaching us to measure many things by their service value rather than by the dollar value. The dollar value in times like this is uncertain. Plan your food gardens and measure their results with rations. Most of the garden vegetables may be canned profitably at home, and only when young and fresh are they at their best for canning. The more of these vegetables that are canned for family use this year, the longer they can be substituted for the foods we are urged to save.

An Efficient, Quick, and Safe Insecticide.

The following note appeared in the *Medical Press*, April 10, 1918, and the subject seems worth drawing attention to again.

Dr. George V. Perez writes from Santa Ursula, Teneriffe: 'The practical knowledge acquired by horticulturists ought to be made use of in modern hygiene where the destruction of insects such as fleas and *pediculi* have been shown by modern investigators to play such an important part in the prophylaxis of disease.

'An emulsion of petroleum and soft soap was used in India with the greatest success for ridding the floors of houses infested by fleas, where cases of bubonic plague had occurred, and it was confirmed that no antiseptic substances acted better than this emulsion as a flea exterminator.

'In the number for August 29, 1914, page 282, of the *Agricultural News*, full details are given of an insecticide, to which its discoverer, Mr. H. H. Cousins, who was also the author of a book entitled *The Chemistry of the Garden*, published in 1898, gave the name of Paranaph, and patented it in 1895; besides soft soap and petroleum, naphthalene enters into its composition, and the combination of those three insecticides seems to enhance the action of each in a remarkable way; this compound, which is quite easy to prepare, following the instructions given, keeps indefinitely, and is a soapy substance readily dissolved in cold water.

'In the proportions of about one ounce to the quart of water, it forms a most wonderful wash in which fleas and *pediculi* perish almost instantaneously, as can be seen during the washing of a dog infested with fleas, or in the case of a human head full of *pediculi*; this would be a very ready and practical way of dipping and washing clothes infested with *pediculi vestimenti*, and one which deserves to be known far and wide, which is the only object of these lines.'

It may be mentioned that the Mr. Cousins referred to above, is the present Director of Agriculture, Jamaica. The formula for making Paranaph is given as follows:—

'To 56 lb. of the best soft soap add 2 gallons of water. Simmer over a fire with constant stirring until all lumps have disappeared and a perfectly uniform melt has been obtained. Add 6 lb. of naphthalene. Stir until dissolved. Remove from the fire, and add 2 Imperial gallons of ordinary kerosene oil. Stir until uniform. The finished product is semi-solid, and dissolves readily in cold water so as to give a milky emulsion.'

Perennial Forage Shrubs.

Experiments which are being made in the Botanic Gardens, Sydney, as to the fodder value of three useful leguminous shrubs from Teneriffe, are noticed in the *Agricultural Gazette of New South Wales*, April 1918. The first of these, *Cytisus proliferus*, is known in its native island as Tagasaste. This is stated to be a leafy shrub with a graceful drooping habit, which does well under dry conditions, and stands considerable variations in temperature from hot to cold. Its quick growth makes it useful as a wind-break, and if kept trimmed, it grows into a pleasing shrub from 8 to 15 feet high. For fodder purposes it should never be allowed to grow into a small tree, but should be cut regularly at least twice a year; the foliage is then always young and soft, and in this state it is readily eaten by all kinds of stock. It is recommended as a safe and profitable stand by in districts where droughts interfere with the cultivation of better fodder.

The second shrub of the same genus is *C. stenopetalus*, called Gacia in Teneriffe. This makes a beautiful, sweet-scented, yellow-flowering shrub, not so large in growth as the Tagasaste, but just as robust, producing thick green foliage.

The third of these shrubs, *C. pallidus*, is known as Gacia blanca, and is even more beautiful as a shrub than the Gacia, because of its charming silvery foliage, although both species bear the same yellow flowers.

Both the Gacias make excellent fresh fodder and silo material, if cut in the same way as the Tagasaste. The flowers also of both of them yield large quantities of nectar, and are exceedingly useful to bee-keepers.

Dr. G. V. Perez of Teneriffe, is interested in having these three plants experimented with in various parts of the world, and would probably be glad to supply seeds for trial in any of the drier West Indies.

INSECT NOTES.

STARCH, INSTEAD OF LIME, WITH ARSENICALS.

In the *Agricultural News* for November 6, 1915 (Vol. XIV, No. 353) the attention of readers was drawn to a cheap and efficient method for poisoning certain caterpillars which are pests of staple crops in St. Vincent. This method was devised by Mr. S. C. Harland, Assistant Agricultural Superintendent of St. Vincent, in the course of his experiments to control the corn ear worm (*Laphygma frugiperda*). Summaries of the information contained in the above article appeared in the St. Vincent Annual Report for 1915-16, and in the *Review of Applied Entomology*, Vol. IV, p. 42.

It has been thought desirable to remind planters of the value of this poison mixture, especially in view of some recent experiments in the control of the corn worm carried out by the Superintendent of Agriculture in St. Lucia, which will be referred to below.

Harland found that by diluting Paris green or arsenate of lead with a low grade arrowroot starch which had been passed through a sieve of eighty meshes to the inch, a mixture was obtained which seemed to have a peculiarly deadly effect upon all kinds of caterpillars. He continues: 'The greater effectiveness of these mixtures, as compared with similar lime mixtures, is thought to be due to the fact that insects usually avoid vegetation where lime is present, and refrain from eating it until actually forced by hunger. A longer period of time thus elapses before the poison is taken in than in the case of starch mixtures, where feeding goes on at the same rate as before. Greater dilution is thus possible with starch mixtures, and the cost of applying poison becomes proportionately less.' Harland states that the additional advantages of starch over lime are that (a) starch adheres better to leaves than lime, (b) it is insoluble in water, (c) it is more pleasant to sift.'

In the course of his observations on the habits of Laphygma in St. Vincent, Harland found that the larvae after hatching from egg-clusters on the leaves, remain quiescent for a time and then migrate to the heart of the young plant where they begin feeding immediately. It was observed that the young larvae showed such a marked tendency to devour each other that it was rarely possible to find more than two full-grown larvae in a single plant. Similar cannibalistic tendencies in this species have been observed by Bodkin in British Guiana (*Journal of the Board of Agriculture of British Guiana*, Vo'. VI, No. 4, p. 172).

Since the larvae of the corn ear worm, or corn worm as it is often called in these islands, remain in the heart of the plant, they are not easy to reach by the ordinary methods of dusting or spraying, and both these methods are wasteful of materials. It has been found that the simplest and most economical method is to drop a small quantity of poison into the heart of each plant, using an ordinary pen nib. (Harland *loc. cit.*)

Experiments with various mixtures showed that both Paris green and lime separately and together burn the leaves of corn, so that they cannot be used against the corn worm. Harland found that the best poison for the control of *Laphygma frugiperda* on young corn is a mixture of lead arsenate and starch in the proportion of 1 : 30 by volume. Paris green and starch may be used against caterpillars on most other crops at the rate of 1 : 60 by volume.

In this connexion a communication has lately been received at this Office from Mr. A. J. Brooks, Superintendent of Agriculture, St. Lucia, in which he gives an account of some experiments which he has been making to control the corn worm.

The 1 : 30 lead arsenate and starch mixture was used in the manner recommended by Harland, except that the starch was passed through a sieve of sixty meshes to the inch instead of eighty.

Brooks has given the following description of his experiments: 'The mixture (mentioned above) was applied by means of an ordinary pen nib, the point being pushed into the soft stem of a piece of bamboo grass, or similar material, to form a handle. The curved base of the pen holds a sufficient amount of the poisonous mixture required to be dropped into the heart of each corn seedling.

'From extensive trials made by this Department (St. Lucia) this mixture has given by far the best results of any ever suggested for dealing with this troublesome pest, which is almost entirely responsible for the lack of interest taken in corn growing locally.

'The processes of dusting by the use of muslin bags or machines formerly employed have always been a failure, the machines getting out of order and the bags tearing or becoming choked through the mixture getting damp. Too much or too little was applied and the results were at the best doubtful.

'Paris green, lime, and such mixtures have never proved satisfactory on corn owing to their burning properties, and in some instances greater injury has been caused by the application of these remedies than by the worms themselves.'

Brooks then goes on to say that the adulterants usually suggested, such as corn meal, etc., are often unobtainable, but that corn is a crop suited to all soils where cassava or arrowroot is regularly grown, so that there should be no difficulty in obtaining a good stock of starch as an adulterant. He suggests that the outer layer of the starch blocks, which is often dirty and unsaleable, could be used instead of the higher grade.

Brooks continues: 'The only apparatus needed is a cigarette tin to hold the mixture and a pen nib to apply it. The planter is not left in doubt as to the results, as the worms leave the heart of the seedling when the poison they have consumed begins to worry them, and they are found stretched out flat and dead on the upper surface of the broad sheaths of the leaves. Our experience has shown that when the mixture is applied just before sunset the worms are quite dead by the following morning.

'A careful test was made by the individual inspection of each seedling in a half-acre plot, and although the infestation had been great, due to the late arrival of the lead arsenate, not a single live worm was found after a period of fourteen hours from the time of applying the poison. During this period heavy storms were experienced and a rainfall of ·82 inch was registered. By following the simple instructions given in the memorandum from St. Vincent absolute success is assured even in spite of unfavourable weather conditions.'

Brooks considers it exceedingly helpful to find such an effective, practical, cheap and easy method of dealing with a pest, and is of the opinion that much more corn could be, and would be grown, if peasants and others knew of such a simple remedy for the greatest trouble they meet in the cultivation of corn.

It would appear then from the above experiments in St. Vincent and St. Lucia that a mixture of lead arsenate or Paris green with starch provides a remedy that is both cheap and efficient, in that only one application is necessary, if

carefully applied in the first instance. These mixtures are especially suitable for use in these islands where starch is easily available, and where the areas under corn are comparatively small. A 1 : 60 Paris green starch mixture has been used by Harland in St. Vincent against the arrowroot worm (*Calpodes ethlius*) with the result that 90 per cent. of the caterpillars were dead in less than twelve hours after the application of the poison.

The writer has seen the results of the use of this lead arsenate starch mixture in St. Vincent against the corn worm and considers that this poison is decidedly worth a general trial by corn growers in the West Indies.

THE CONTROL OF CORN CATERPILLARS.

THE CORN EAR WORM (*Laphygma frugiperda*).

THE BOLL WORM (*Chloridea* [Heliothis] *obsoleta*).

Both these pests attack Indian corn in much the same way by feeding on the leaves and by boring into the ears. While the two species of caterpillars are alike in their habits of feeding, the adult moths differ in their egg-laying habits. The female of Laphygma deposits eggs on the leaves in clusters which are more or less thickly covered with greyish down from the moth's body, while the Heliothis female lays eggs singly on various parts of the plants. In the United States the number of eggs in a cluster of Laphygma range 'from fifty to several hundreds' (*Farmers' Bulletin, 752*), while Heliothis lays 'from nearly 500 to almost 3,000 eggs' (*Farmers' Bulletin, 872*).

CONTROL. The collection of eggs is hardly a practicable measure against either of the above pests, at any rate where corn is grown on fairly large areas. Harland found that the collection of Laphygma egg-clusters was practicable over a small area, since the clusters are easily seen, but even on half an acre of corn the masses were being collected at the rate of 300 per day.

The best method of controlling Laphygma in the West Indies is the application of the lead arsenate starch mixture in the manner described above. The boll worm often attacks corn at the time when this plant is 'silking' and lays its eggs on the corn silks. The hatching larvae eat their way through the silks and attack the immature ears. Advantage is sometimes taken of this egg-laying habit to dust the corn silks with a poison mixture. It is suggested that the lead arsenate and starch mixture be tried against Heliothis.

THE MOTH BORER (*Diatraea saccharalis*).

The moth borer often attacks corn in a manner very similar to that in which it injures sugar-cane. The best method of controlling this pest is by collecting the egg-masses which are laid on the leaves. These masses are often well parasitized. The darker egg-masses should be left on the leaves, if possible, to allow the parasites to emerge. The lighter masses should be collected and destroyed.

Harland (St. Vincent Annual Report, 1915-16) has found that Diatraea shows a marked preference for laying eggs on Indian corn rather than on sugar-cane, even when corn is planted along the edge of the cane plot. The old corn stalks should always be removed after the crop, as if these are left standing in the field the infesting larvae will be able to complete their development.

The stalks can be cut as soon as the crop is harvested and used for litter in cattle pens; the stumps should be removed at the same time. This method will destroy most of the larvae and pupae, and is a very effective measure of control.

J.C.H.

PRIMARY EDUCATION IN BRITISH GUIANA.

The report of Mr. H. W. Sconce, the Director of Primary Education, British Guiana, for the year 1917, has lately been received at this Office. Much of it is, of course, more or less of local interest, but it touches upon many subjects which are of general importance with regard to primary education in all these colonies.

One of the sub-Inspectors, Mr. Lawrance, makes some pertinent remarks as to training in manual occupation.

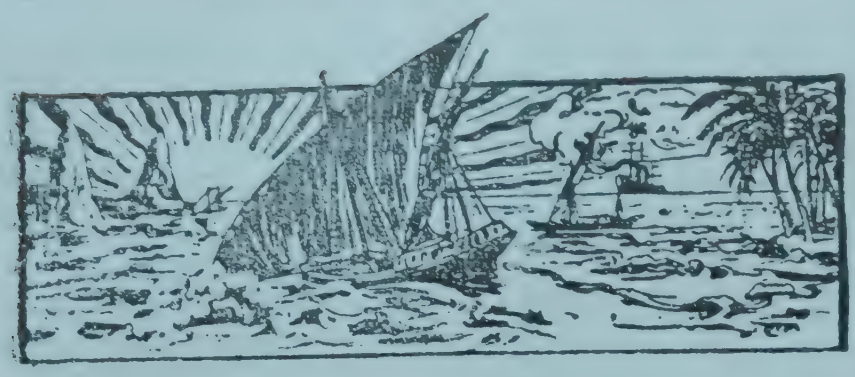
Time spent on work of this kind, says Mr. Lawrance, is regarded in some quarters as time wasted, and so it is, when the work is not done properly; but that does not appear to be a conclusive argument against the utility of a subject which undoubtedly introduces a welcome variety into the school course. Besides that, however, such manual work has an educational value of its own, in fostering habits of close attention, in co-ordinating hand and eye, and in providing the means of self-expression.

The same sub-Inspector criticizes the teaching in nature knowledge as very often lacking in interest. Provision is seldom made for first-hand examination of objects. Too much stress is laid on the memorizing of facts, and too little on preparing the mind to recognize and receive them.

In connexion with nature study, the subject of school gardens naturally presents itself. It seems that, on the whole, there is a considerable amount of useful work done in the school gardens throughout the colony of British Guiana in the course of a year. The report truly remarks that the object of a school garden is to lead pupils of suitable age to a first-hand knowledge of natural processes, to give a practical turn to their instruction, and to create and foster in them a liking for agricultural pursuits. This, it may be said, is the object to be aimed at by the establishment of school gardens everywhere.

Part of the report is taken up in the discussion of certain clauses of the New Draft Education Code of 1917. The Director of Education says that the chief mistake in the past has been the tendency to treat all schools alike, but that in any system of payment by individual results such a tendency is practically unavoidable. Now, however, it is proposed to abolish in its entirety the money value of a subject of instruction, or of an individual pass. It will be quite feasible, therefore, to allow a large amount of freedom to school authorities in the drawing up of a course of instruction, the promotion of pupils, etc , and at the same time to enable the government to have complete control over the efficiency of the schools and the teachers. The cast iron system of a uniform curriculum, and of a uniform number of classes and standards for schools in all parts of the colony, and for all the children of the six different races which inhabit it, is, the Director trusts, departed forever. Every school, however, will be required to pay due attention to the reading, writing, and speaking of English, to arithmetic, manual work, hygiene, and physical training.

With regard to school gardening in the future, the Director quotes with approbation some remarks of a Trinidad Education Commissson on the subject: 'We recommend that every country school should have a garden in which practical gardening should be taught on lines to be approved of in advance by the Director of Agriculture. There should be no special bonus for school gardening, but no country school, which did not possess a suitable and properly equipped garden and a qualified teacher for it, should be graded as a first class school, however satisfactory its work in other respects might be.'



GLEANINGS.

The estimated output of date palm sugar in Bengal in 1917-18 is calculated as 101,000 tons, as compared with 99,700 tons in 1916-17. (*The Board of Trade Journal*, May 16, 1918.)

An embargo has been declared against the shipment of grape fruit from Cuba in order to conserve space for war essentials on ships leaving there. Pine-apples and bananas are the only fruit which do not come under the embargo. (The *Cuba Review*, May 1918.)

The cultivation of the castor oil plant in Santo Domingo has become very profitable, and a contract for 500,000 bushels of castor beans has been recently placed by the United States Government with a local firm. (*The Board of Trade Journal*, May 23, 1918.)

A note in the *Chamber of Commerce Journal*, May 1918, states that experimental work in coco-nut planting is being carried out by the Federated Malay States Department of Agriculture, and from measurements of the rates of growth of young palms it would appear that Malaya can produce these of 50 per cent. better growth than that recorded from other countries.

From the *Daily Argosy* of Demerara for June 22, 1918, we learn that the food problem in Surinam was getting more serious each day. In fact there is real danger of famine. The Dutch Guiana newspaper, *Suriname*, expected, however, that the food situation would be relieved by the end of the month by supplies of flour from the Argentine, and foodstuffs from Venezuela, which are said to be on the way.

In the course of a lecture on Cotton Growing in St. Vincent, reported in the *Sentry*, June 21, 1918, Mr. W. N. Sands remarked that what the control of cotton stainers meant was shown by the fact that from July 1, 1916, to January 31, 1917, the operators caught 204,660 stainers in the cotton plots, whereas for the same months of 1917-18 they caught but twenty-five, and these at the close of the cotton-picking season.

In Canada the shipping of day-old chickens, in preference to eggs, is becoming very general. The method of packing is quite simple, strong cardboard boxes being used in sizes to hold a dozen, twenty-five, fifty or 100 chicks, respectively. The *Agricultural Gazette of Canada*, May 1918, gives reports on this method from several agricultural officers. It is stated that even when the chickens are forty-eight hours on the road very few losses occur.

It is stated in Hawaii, that the Olaa Plantation's proposed bagasse paper plant will be superior to what was expected. The manager of the company shows more than a dozen different grades of paper manufactured from bagasse, which lends itself, in reality, better to the production of the high and finer grades of paper than it does to the coarse product for mulching purposes, for the production of which it is chiefly intended. (The *Louisiana Planter*, June 1, 1918.)

A note on the production of sugar beets in Canada, which appears in the *Cuba Review*, May 18, 1918, states that the total of 117,600 tons from 14 000 acres was produced as the crop of the season of 1917. All this production was from the Province of Ontario. A large number of Belgian sugar beet workers are now residing in Canada, and beet production is increasing. In the past season the refineries paid $8·73 per ton for beets, an increase over the previous year of $2·73 per ton.

At a meeting of the Antigua Agricultural and Commercial Society held on June 8, 1918, the Chairman, Mr. A. P. Cowley, stated that the Secretary, Mr. T. Jackson, as Curator of the Agricultural Department, had ordered for planting purposes several thousand pounds of black-eye peas, sufficient to plant approximately 400 acres of land. It seems as though these peas might have a considerable effect in a few months time in supplying the people with a very nutritious food. (The Antigua *Sun*, June 18, 1918.)

The Board of Trade Journal, May 16, 1918, notes that during the past year a systematic study of possible means of effecting improvements in the actual manufacture of indigo in India has been in progress. It is hoped that by controlling the bacterial action during the process of fermentation, a considerable improvement in the yield may be effected. Surprising increases in the yield of indigo are reported to have been obtained this season at many factories by the use of the so-called 'dhak' gum, which promotes better settling.

In 1917 the United States took 71 per cent. of the world's total output of rubber. Practically all the plantation rubber produced in the world is at present grown in the East. The plantations occupy about 2,000,000 acres, of which approximately 1,000 000 are in the Malayan Peninsula, 500,000 in the Dutch East Indies, and the remainder distributed through Ceylon, India, Burma, Cochin China, and Borneo, with a comparatively small acreage in the Philippines. Forest rubber, on the other hand, is chiefly produced in South and Central America, and West Africa. (The *India Rubber Journal*, May 11, 1918.)

A correspondent of the Jamaica *Gleaner*, May 17, 1918, advocates the use of boiled yam mixed with flour for bread making. The yam, having been previously boiled, is well mashed, and mixed with flour dough in the proportion of 2 parts flour and 1 part yam, the water in which the yam was boiled being used as the liquid to make the dough. Dough mixed in this manner rises, he says, much quicker than that made with flour alone, and the bread made in this way is as light and white, and will keep as long as the ordinary all-wheat bread, being indistinguishable from it in taste.

FRUIT CULTIVATION IN TRINIDAD.

A special committtee of the Agricultural Society of Trinidad was appointed on August 12, 1917, under the chairmanship of Mr. W. G. Freeman, Acting Director of Agriculture, to report on the above subject.

The terms of reference to the committee were:—

(1) To ascertain what fruits of merit already exist in the colony, with a view to their cultivation for local use or possible export;

(2) To recommend the importation of any desirable new fruit;

(3) To ascertain what markets are available out of the colony, especially for citrus fruit, mangoes, and avocados;

(4) To recommend measures for the establishment of of a fruit industry in Trinidad and Tobago on a business basis;

(5) To make recommendations as to handling, packing, and grading fruit for local and export trade.

The committee presented its report to the Society on May 9, 1918, a copy of which has been forwarded to the Imperial Commissioner of Agriculture.

The committee recommends that for purposes of an export trade attention should at first be directed principally to oranges, grape fruit, and mangoes. There exist in the colony many excellent varieties of oranges, and ample material is available for their more extensive propagation. Good, well-known, commercial varieties of grape fruit are already in the colony, and the committee recommends that other good kinds should also be introduced and tested. Both of the local varieties the committee considers worthy of propagation.

With regard to mangoes, several of the varieties which have already proved successful in the colony seem to be well suited for export. The Department of Agricultnre has about forty varieties under cultivation, among which are some Indian mangoes of high reputation. With regard to avocados, the excellent varieties in the colony can readily be propagated by budding, but the supply does not equal the local demand.

Among other fruit to which the committee draws attention is the Sapucaya nut (*Lecythis Zabucajo*). This nut, a relation of the Brazil nut, to which it is usually considered superior, has already been introduced, and the plants are thriving in some localities. It has not however fruited in the colony as yet.

Trees of the mangosteen, one of the most delicious of tropical fruits, thrive and bear moderately well at the St. Clair Experiment Station. A limited supply of young plants it usually available each year. The tree does much better however in moister localities.

There seem to be only four trees of another very highly prized fruit, the Litchi, at present growing in the Botanic Gardens. These do not seem to have borne very successfully, but the committee considers that trials of this fruit in other localities are desirable.

More attention, the committee thinks, should be given to the sapodilla, by growing plants from specially selected seed of the excellent Tobago strains. Tobago offers better opportunities than Trinidad for this purpose, as sapodillas are not attacked there by the fruit fly.

Pine-apples do well in some localities in Trinidad, for instance at LaBrea, where was formerly established a canning industry. Experiments are being made with importations of fresh strains of pine-apples from Porto Rico, the results of which are being looked for with interest.

It is recommended that papaws should be more largely grown for local consumption, as there is always a demand for papaws of good quality in the local market.

Attention should be given, the committee states, to the selection and cultivation of good varieties of guavas. The large spice guava is always in demand locally as a dessert fruit Tobago, however, offers better opportunities for guava cultivation, owing to freedom from fruit fly.

More attention might be paid to the cultivation of grapes, which are already successfully grown in a few places. The green Muscat, and some black varieties do well. A dry district with facilities for irrigation will probably prove the most suitable for growing grapes.

Among new fruits which have been received by the Department of Agriculture during the last few years, plants of which have been successfully raised, are two edible passion flower fruits (*Passiflora edulis*) and (*P. maliformis*), two other species of which are already well known, viz. the water lemon or bell apple (*P. laurifolia*), and the granadilla (*P. quadrangularis*). Selected varieties from Egypt of the date palm are also growing successfully, as are also plants of the well-kown Durian of Malaya (*Durio Zibethinus*).

In order to obtain information regarding the possibilities of an export trade in fruit to the neighbouring colonies and elsewhere, the chairman made enquiry of other West Indian Agricultural Departments. From the information received it appears that Barbados is an immediately promising market, while there is opening in St. Kitts also for a small general fruit trade, and in Antigua for grape fruit only. Possibly, later on, when the industry has developed sufficiently to form a strong organizatlon capable of doing a steady business on a large scale, a good market might be opened in Canada.

Six trial shipments made to Bermuda of oranges and grape fruit, to fill an order received from that colony, have been very successful, the gross profit of $683·95 having been obtained on a shipment altogether of 514 crates.

In conclusion, the committee recommends the formation of a Co-operative Fruit Growers' Association for both export and local trade, and suggests that this could be worked on the same general lines as the Antigua Onion Growers' Association.

The advantages of such co operation ought to be obvious. Without it a number of individuals casually send small consignments, of fruit to the market probably in competition with other local producers. The result is that small and irregular consignments of poorly graded fruit prevent any possibility of Trinidad and Tobago fruit of a definite standard becoming recognized in a distant market. Secondly, by the work of a properly organized association the expense of marketing is considerably reduced. And thirdly, what is of most importance, only fruit of definite grades, packed in a standard manner, are despatched, so that the Association fruit may earn a reputation for uniformity and quality. Such an association could make a beginning by trading with Barbados, Bermuda, and, on a small scale, with St. Kitts and Antigua.

The abnormal prices obtained for honey during the past two months has caused very many persons to start bee keeping in Vere parish, Jamaica, while old bee-keepers have been enlarging their apiaries. It is true that the fall in the price which has recently taken place has reduced the profits very much. It is confidently expected, however, that the price will not go below 12*s.* per gallon when the market has become settled. (The Jamaica *Gleaner*, May 2, 1918.)

PLANT DISEASES IN BRITISH GUIANA.

Mr. C. K. Bancroft, in the *Annual Report of the Department of Science and Agriculture of British Guiana*, 1916, gives the following summary of the position regarding plant diseases during that year:—

'Fungoid diseases were not prevalent during the year. Spasmodic cases of *Marasmius Sacchari* were reported; this disease appears to have been continually diminishing since 1914. The other fungi parasitic on sugar-cane, with the exception of *Leptosphaeria Sacchari*, "ring spot", were observed only in small quantity. The ring spot disease was present on several plantations, though the damage attributable to it was small. Cases of bud rot of the coco-nut continue to appear more particularly on the Canal Polder and on the Essequibo coast. The "witch broom" of cacao continues to diminish as the result of careful pruning of the trees and improvement in drainage. No fresh disease was recorded during the year. The principal fungoid diseases of the lime plant during the year were "collar rot" and "wither tip". These, however, were not prevalent; the former was confined almost solely to limes on heavy clay land. The leaf disease of the Para rubber tree showed distinct diminution towards the end of the year. The trees growing at Christianburg and Wismar on the Demerara River, are, however, still very badly affected, and it is feared that the cultivation of both of these places will be ruined. A fairly uniform wintering in February to April 1917 has been followed by a still further improvement in the condition of the trees in other parts of the colony.'

THE SMALL VEGETABLE GARDEN.

Nowadays, when everyone is being urged to do his best in producing more food crops, advice on the above subject contained in *Farmers' Bulletin, 818*, of the United States Department of Agriculture, is not only interesting but useful.

By the exercise of care and forethought in planning the succession and rotation of crops, and by the utilization of every foot of available space, it is possible to grow considerable quantities of vegetables on limited areas, and so supplement the family food supply.

The primary needs for successful vegetable gardening on a small scale are the same as those for market gardening on a large scale. On limited plots, however, more attention must be paid to intensive culture, and to carefully arranged rotation of crops in order to produce the maximum yield. A great deal also depends upon the care the gardener bestows on his plot.

The soil of every garden should be of a relatively open texture, in order that the rootlets of the vegetables may readily extend themselves in the search for the plant food stored in the soil. To maintain this open condition, a high proportion in the soil of humus—that is to say, rotted vegetable material—is most desirable, since it not only produces an open texture, but adds nitrogenous plant food, and also ensures the presence of beneficial bacteria, and increases the moisture-retaining properties of the soil.

About 50 per cent. of ordinary earth is not soil at all, but consists of air and water. Water dissolves the plant food that is present in the soil, and thus renders it available for use by the plant, while the air in the soil tends to bacterial development, and facilitates chemical action on the mineral constituents necessary to plant growth.

With a little forethought a comparatively small tract of land may be made to supply the average family with fresh vegetables throughout the year. Most owners of small gardens are content to raise a single crop at a time on their plot of land. It is quite possible, however, to grow two or three crops of some vegetables on the same bit of ground, if these are properly selected. It will pay the small gardener to grow certain specialties of which he may be particularly fond, and which it may be troublesome or expensive at times to purchase. Little beds also of parsley, thyme, and other pot herbs take up very little room, and are always most welcome to the housekeeper.

Every available foot of the small garden plot ought to be made to produce continuously. It is well, therefore, carefully to plan the lay-out for the garden in advance. No more space should be allotted to each crop than is needed to furnish the sufficient quantity of the vegetable desired for consumption. It is well to remember also that many kinds of vegetables may be interplanted, but plants which make a high growth and cause heavy shade should not be planted to interfere with small sun-loving plants.

In this connexion it must be remembered that if a successful garden is to be maintained, the greater portion of the plot must have at least five or six hours of sunlight a day. As a rule, crops which are grown for their leaves, such as lettuce and cabbage do fairly well in partial shade, but even these need several hours of sunshine a day. Plants which are grown for their fruit, such as tomatoes and egg-plants, should have a plentiful supply of sunlight.

The most practical device for use by the small gardener for starting his vegetables is a flat seed-box. Any sort of wooden box filled with good soil answers the purpose, but a good size is one of 3 or 4 inches deep, 12 or 14 inches broad, and 20 to 24 inches long. A layer of about 1 inch of gravel should be placed on the bottom of the box, which should then be nearly filled with rich, fine soil. In the West Indies it is very desirable to protect seeds sown from the depredations of ants. For this purpose it is well to add four legs to the box, and to place under each leg an empty butter tin partly filled with water to which about a tablespoonful of kerosene oil has been added.

When the young seedlings are from 1 to 1½-inches high they should be thinned to 1 or 2 inches apart, so as to give them space enough to make a strong, stocky growth. If it is desired to keep the plants which are thinned out, they may be set 2 inches apart each way in boxes similar to the seed-box. A good watering should be given just before the plants are taken out of the box for transplanting, so that a ball of earth should stick to the roots of each one. Transplanting, if properly done, instead of injuring them, seems to help the plants to develop a strong root system. In planting out the plant should be lifted with a trowel, keeping as much soil as possible on the roots, a hole opened in the ground, the earth-encased roots of the plants inserted, the soil drawn up to the stalk, and then pressed down with the hand. When all the plants are set, the surface round each plant should be carefully raked.

Since a number of vegetables continue to mature almost throughout the year, it is possible to utilize the same space for successful plantings of the same vegetables, or for rotation planting of different ones. For successive planting the gardener should not sow all his seed at once, but should make successive plantings at intervals of about two weeks. In this way it is possible to grow almost continuous crops of such things as radishes and lettuce. In planting rotations of crops, it is well that in type and character of growth the succeeding crop should differ as widely as possible from the crop which it follows. It is well to divide the plants grown in a vegetable garden into root crops, such as

beets and carrots; fruit crops, such as tomatoes and egg-plants; and leaf crops, such as cabbages and spinach.

The importance of continual and careful cultivation after the plants have been set out cannot be too strongly emphasized. The gardener should never permit the surface of the soil to become baked, or even to form an appreciable crust. The rake is perhaps the gardener's most valuable tool in cultivation, but where the ground has become compacted beneath the immediate surface, other tools must supplement the rake. Close chopping with a garden hoe will break up such hardened soil satisfactorily, and put it in good condition, the finishing touches being given to the surface with a rake. Care must be taken, however, not to cultivate when the soil is too moist, although, on the other hand, to prevent a crust forming, the ground should be stirred as soon as the moisture from rain has soaked in or partially evaporated.

A POSSIBLY USEFUL TREE.

There is a small tree or shrub widely spread throughout the tropics, and well known in the West Indian islands under different names, which is usually looked upon as more or less of a nuisance, but which it appears might form the basis of some minor industries if exploited. This is *Acacia farnesiana*, belonging to the Mimosa tribe of the order Leguminosae. It is known in Barbados as 'sweet briar' on account of its numerous thorns and the exquisite odour of its flowers. In Antigua it is called 'stinking cossie'—the last word probably being a corruption of Acacia, and the adjective attached referring to the particularly disagreeable smell of the wood when cut. In the French islands it is called 'pompon jaune', and in Cuba it goes by the name of 'aromo amarillo', in both cases evidently on account of the colour of its flowers. This plant is so widely distributed throughout the West Indies, growing especially vigorously on poor and rocky soils, that there is no need to enter into a detailed description of its appearance.

It is said to have originally been brought from Mexico, and to have been cultivated in the Farnese Garden at Rome, to which circumstance it owes its botanic specific name. At the present time it is cultivated on a commercial scale in Italy, Spain, and Southern France for the sake of its fragrant flowers which are employed in the perfumery industry. The annual value of the crop of the flowers of this plant in France is stated to be thousands of francs, and a particularly delicate and fragrant perfume is extracted from them. The flowers are very commonly used in the West Indian islands to fill sachets for placing in wardrobes in order to impart a pleasant odour to clothing contained in them. The pods, which are produced in considerable numbers, contain a fair amount of tannin, and might be utilized in the preparation of leather. From cracks in the bark of the trunk and branches there exudes a gum which is hardly to be distinguished from the true gum arabic, and is utilized for the same purposes. When freshly cut, the wood exhales a very disagreeable odour, somewhat similar to asafœtida. It is a very hard and handsome wood, and although the trees do not attain to any considerable size, the larger portions of the trunk are employed by joiners in small woodwork. The wood is utilized also for the production of charcoal, for which purpose it is much valued in the West Indies.

Besides the above commercial purposes to which *Acacia farnesiana* might be put, it is also credited with possessing valuable medicinal properties. The *Revista de Agricultura, Commercio y Trabajo* of Cuba, for March 1918, has an article on this plant in which reference is made to *El Medico Botanico Criollo*, a book which appears to treat of the medicinal values of Cuban plants. According to this reference, an extract of the flowers of *A. farnesiana* in alcohol may advantageously be employed in cases of dyspepsia. An infusion of the green pods in cold water possesses a strongly astringent property, and has been used with effect for that purpose, although the disgusting smell of the infusion makes it ordinarily unacceptable to patients.

In the future, should the West Indian islands ever become sufficiently populated to enable small industries to be profitably carried on, *A. farnesiana* might prove of value as one of the many plants which might be utilized in a local perfume industry. Whether the pods could profitably be utilized in local tanneries, to which attention has been lately directed in several of the smaller islands, might be a matter of experiment. At any rate, *A. farnesiana* need not be looked upon as altogether a pest, considering the many useful products which it is capable of supplying.

AGRICULTURE IN BARBADOS.

The weather for June has been ideal. Although the amount of rain which has fallen has been less in several districts than last year, better weather has prevailed inasmuch as the rainfall has been excellently distributed.

Very satisfactory progress is being made with the tillage of the fields from which the cane crop has been reaped. Cane hole digging is being proceeded with very rapidly on black soil estates, and preparation for the planting of provison crops is being hastened. We have noticed some very good preparation for potatoes.

A very large area of corn has been planted. In many instances more has been put in than was required by law, and, as far as we can judge the fields of this cereal are in a much more satisfactory condition than at this time last year.

The present scarcity of potatoes will not be relieved before the end of August, but thenceforward there should be a steady supply.

Most fields of Lisbon yams have only just started to grow and they are receiving a fairly liberal supply of farmyard manure. Taking the outlook as a whole, there need be no anxiety, if favourable weather continues, concerning the supply of locally grown food. It cannot be sold at prices as low as those to which we were accustomed, but it will be secured at rates reasonable in the present crisis. For all that we have said, we would advise all peasants and holders of small areas of land to supplement as far as they can what is being done under 'The Vegetable Act'.

The young cane crop, though not very forward, is looking well and bunching satisfactorily. Here again, the B.H. 10 (12) is showing to the best advantage. There are some fine fields of this seedling to be seen in almost every parish. The bunches are very full, the foliage very green, and the shoots are remarkably strong and bulky. In our report at this date last year we noted that the B.H. 10 (12) had developed fewer dry hearts during the dry season than had the other two favourite seedlings. We have to record the same thing again this year.

There continues to be very great scarcity of artificial manures. A few estates which bought very early have secured their season's supply, but, generally speaking, only very small quantities are being doled from each shipment. The cost of sulphate of ammonia at the present time is about $186 per ton, as compared with $135 last year, and $100 in 1916. (The Barbados *Agricultural Reporter*, June 29, 1918.)

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, May 16.

ARROWROOT—No quotations.
BALATA—Venezuelan Block, 3/5 to 3/7½; Sheet, 3/11 to 4/3.
BEESWAX—No quotations.
CACAO—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 2/9 to 3/6: concentrated, £32; Otto of lime (hand-pressed), 16/6.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—No quotations.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., June 27.

CACAO—Venezuelan, $10·75 to $11·00; Trinidad, $11·00 to $11·75.
COCO-NUT OIL—$1·36 per gallon.
COFFEE—Venezuelan, 10c. to 11c. per ℔.
COPRA—$6·75 per 100 ℔.
DHAL—$12·50.
ONIONS—$2·50 per 100 ℔.
PEAS, SPLIT—$11·00 per bag.
POTATOES—English, $3·00 per 100 ℔.
RICE—Yellow, $13·00 to $13·25; White, $9·00 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS. & Co., June 8.

CACAO—Caracas, 12¼c; Grenada, 12½c. to 13c.; Trinidad, 12⅝c. to 12⅞c.; Jamaica, 10¾c. to 11¾c.
COCO-NUTS—Jamaica selects, $34·00 to $36·00; Trinidad $37·00 to $39·00; culls, $17·00 to $19·00 per M.
COFFEE—Jamaica, 9¼c. to 11c. per ℔.
GINGER—15c. to 17c. per ℔.
GOAT SKINS—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per ℔
GRAPE FRUIT—Jamaica, importation prohibited.
LIMES—Importation prohibited.
MACE—40c. to 48c. per ℔.
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Plant Physiology and Agriculture.

AGRICULTURE in the strict sense of the word means the cultivation of the soil for the purpose of obtaining the yield of the product of plants valuable to man. It must have been one of the oldest arts practised by members of the human race. Probably, in the first instance, primitive man selected for his agriculture the plants which he liked best to eat, and then, by degrees, through selection and cultivation, better strains of plants were produced. Wild plants, it is well known, are greatly modified and improved under the influence of cultivation and selection, so that it is easy to realize that great changes have been produced by centuries of such treatment under varying conditions of soil and climate.

The adaptation of a plant to suit a new environment, or the modification of the environment to meet the requirements of the plant, is an achievement of agricultural science of comparatively recent times. In fact, such attempts must have been more or less empirical, until the very modern development of plant physiology. The scientific study of the effect of soil and surroundings, together with the knowledge of the vital processes of plants, is enabling modern plant physiologists to state fairly accurately on *a priori* grounds what will be the behaviour of any particular plant when subjected to the influence of different climates and soils, and vice versa, what the effect of any given environment will be upon the plants subjected to it.

The importance of the scientific and practical knowledge of plant improvement has been more and more realized in the last fifty years. There is now scarcely an important crop of temperate climates that has not been greatly improved in various directions. The work of plant physiology on tropical crops may be said only to have just begun to show tangible results, but the results already obtained demonstrate that this science is destined to produce in the plants cultivated in tropical regions results as greatly beneficial as it has already produced on those of temperate climates, which have been longer under its influence.

Plant physiology has as an object the study of the manner in which the lives of plants are influenced by temperature, soil, and moisture.

The study of the conditions under which the life of the plant can be best maintained has had the most important bearing on agriculture. It is only within the last 200 years that the manner in which plants obtain the substances necessary for health and growth has been scientifically studied, and accurate results obtained. Up to the end of the seventeenth century it was believed that plants obtained all their food from the soil, although the elements constituting even the food so obtained were not then known. In fact, it may be said that not until the middle of the nineteenth century did the researches of Liebig and Boussingault, on the subject of plant nutrition, afford such information on the point, that the knowledge could be of real profit to agriculture. From that time on, however, rapid progress has been made in the study of the complex chemical and physiological problems relating to the assimilation by plants of the several food elements necessary to their growth under various conditions, and which are derived from various sources.

The demonstration of the requirements necessary for the growth of most cultivated plants has given to the agriculturist the knowledge of the means essential to maintain and increase the fertility of the soil. In fact, in many cases, soils that were long considered hopelessly barren have been rendered fertile by putting into practice the knowledge thus acquired. The knowledge too that plants need light and air, and that really the larger portion of their food is obtained by them from the atmosphere, has in many cases led to a considerably greatly increased yield of certain crops, by a modification of hitherto practised methods of cultivation, each individual plant being now given more room in which to grow. The art of feeding plants, based on the scientific knowledge of plant nutrition, has developed remarkably of late years. As an article in the *Yearbook of the United States Department of Agriculture*, 1904, puts it: 'the well informed farmer now knows that the varying combinations of essential conditions and elements that occur naturally in different soils and climates are an index to the adaptability of these climates and soils for special crops. He knows also that these conditions can be modified favourably or unfavourably by cultivation and fertilization. He understands the importance of a physical and chemical examination of soils as indicating the presence or absence, and the relative proportions of the essential elements of plant food.'

Whether certain crops, however, are adapted to particular conditions, or whether the conditions may be made more favourable, has to be determined under actual trial; and this is really the work of the plant physiologist. His examination of this question would also relate to the determination of the micro-organisms present in the soil, and the beneficial or injurious changes which they might produce. Some bacteria and fungi cause the decay of organic remains of animals or plants, leaving the nitrogen and other elements of plant food in forms available for assimilation by other plants. On the other hand, there are organisms which produce conditions of soil directly or indirectly unfavourable to crops. The work of the physiologist is to study the life-history and habits of all these forms, so as to put the useful kinds to work, and to eliminate the injurious ones.

Investigations of plant physiologists on the causes, prevention, and cure of plant diseases, have also been of immense benefit to modern agriculture. This scientific investigation of plant diseases, which has been conducted for little more than half a century, has already resulted in the discovery of remedial measures which have been the salvation of many crops in various countries.

In this connexion it appears that the best results have been obtained because physiologists are concerning themselves in enquiries into the life condition of the plants affected by disease, rather than confining their attention to the diseases themselves.

It will thus be seen that agriculture is much indebted to the development of the science of plant physiology, which, first, has very greatly increased the power of the practical agriculturist to secure harmony between crop and environment; in the second place, it has enabled him to maintain and increase the fertility of soils by the knowledge of the elements required for their nutrition; and thirdly, it has shown him how to increase the yield and quality of crops by setting to work to improve nature's machinery for the accumulation in the soil of compounds available to the plants. Plant physiology also has discovered the causes of, and found remedies for, many of the most destructive diseases of all kinds of crops. The result of this is that in modern times the intelligent planter or farmer is enabled to protect and control his crops to a wonderful degree, so that it may be well said that scientific agriculture is fast becoming if it has not already become, one of the safest forms of investment of capital and labour.

SUGAR INDUSTRY.

SMALL SUGAR-CANE MILLS.

Owing to the abnormally high price of sugar, a good many enquiries are being made just now with regard to the possibility of using small mills in remote places. The following information received by the Imperial Commissioner of Agriculture for the West Indies from Mr. W. Robson, Curator of the Botanic Station, Montserrat, as to the working of such small mills in that island, will probably be useful in this connexion.

Mr. Robson reports on five small mills, two of them driven by steam engines, and three by oil engines.

Of the steam engines, the one at Olveston is a 4 h.p. Blymer engine, driving a mill with rollers 14 inches long, at a steam pressure of 60 to 70 lb. This will grind about 11 tons of cane per day, which produces 3½ tons of sugar per week. The other steam engine at Lees is a 6 h.p., driving rollers 2 feet long. This makes 50 bags of sugar a week when constantly working.

Of the oil-power engines, the one at Parsons is a 6½ h.p. Wilson magneto oil engine, driving rollers 12 inches long. This turns out 1,100 gallons of juice per day of twelve hours, which produces 3½ barrels of sugar per day. At Roches, the 6 h.p. American oil engine, driving a mill with rollers 15 inches wide, yields 120 gallons of juice per hour, which produces 4 barrels of sugar per day. The mill at Brades, which seems of a particularly good type, has a Hornsby engine of 10 h.p. using low flash kerosene oil, and the mill is from McKinnon, of Aberdeen, with rollers 18 inches long. With the engine working full power a yield of juice may be obtained of 200 gallons per hour. One ton of sugar can be turned out per day.

A SIMPLE AND WHOLESOME SYRUP.

The *Louisiana Planter*, June 22, 1918, reproduces the following from the *International Confectioner*. The process described is simple enough, and the product would appear to be worth some attention at the hands of those engaged in making sweets:—

Cane or beet sugar can be inverted by the simple process of heating in the presence of an acid. The chemical reaction that takes place results in the same products being formed as are formed when the sugar (sucrose) is taken into the human body, the sugar forming equal parts of dextrose and levulose. The following formula may be used in making invert sugar syrup of such sweetness that a pound of the syrup will replace a pound of sugar:—

100 lb. of sugar.
44 lb. of water.
1¾ oz. of powdered tartaric acid.

These ingredients are mixed together and boiled for thirty to thirty-five minutes. If boiled longer than thirty-five minutes the syrup darkens in colour, and a flavour develops which tends to make the syrup resemble glucose syrup, and this is somewhat undesirable. This solution boils at a temperature of 220 degrees Fahrenheit. A steam pressure kettle can be used, or an open candy kettle over a steady fire. If the solution is boiled too vigorously there will be too large a loss by evaporation. Ordinarily the loss will be from 3 to 5 per cent.

The above formula should make 140 lb. of syrup, and if there is considerable loss due to evaporation, the syrup can be brought up to this weight by the addition of water. The resultant invert sugar syrup is not unlike strained honey in appearance and taste. It contains 71·4 per cent. of sugar, and tastes considerably sweeter than a sugar syrup of the same strength. It can be used in the same proportions as sugar the amount necessary for 10 gallons of ice cream being 6·5 lb. to 7 lb. It gives very satisfactory results in freezing, and a pleasant flavour in the finished product.

It can be readily seen that by using the above method, the sugar supply can literally be stretched, for with only 71·4 per cent. as much sugar as is now being used in ice cream, the same degree of sweetness can be obtained.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and seventy-second meeting of the Council of the British Cotton Growing Association was held at the Offices, 15, Cross Street, Manchester, on Tuesday, June 4, 1918. In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.), Mr. Joseph Watson occupied the Chair.

WEST AFRICA. Reports have been received that large quantities of seed-cotton are being bought in the local markets for the native weaving industry, which has received a big impetus on account of the high price of European cotton goods. Even in the Southern Provinces, where the industry had practically become extinct, large quantities of cotton are being used for making native cloths. The local demand has greatly affected the Association's purchases this year, and, in addition, the crop is a short one, owing to unfavourable climatic conditions during the growing period.

The purchases of cotton in Lagos to May 25 amounted to 2,074 bales, as compared with 6,379 bales for the same period of last year, 7,845 bales for 1916, and 2,656 bales for 1915.

The purchases in Northern Nigeria to April 30 amounted to 2,238 bales, as compared with 3,540 bales for the same period of last year, 9,617 bales for 1916, and 282 bales for 1915.

The crop of long staple American cotton grown in the Zaria district under the direction of the Government Agricultural Department is now practically all bought, and the Association's purchases amount to over 800 bales, as compared with 462 bales last year. A good deal of this cotton has also been used locally, and there is every reason to believe that the cultivation of this type of cotton in Northern Nigeria will continue to increase rapidly.

NYASALAND. It was reported that Nyasaland and South East Africa generally have suffered from some exceptionally heavy floods, and the Zambesi River has been flooded higher than the previous record, and the Shire River was as high as during the flood of 1914. Thousands of natives have lost their lives in the flood, and millions of acres of crops have been destroyed, and considerable damage done to property.

Owing to the restriction of the cotton area in Egypt, that under sugar-cane this year is expected to exceed that of last year considerably. Weather conditions are said to have materially reduced the sugar contents of the cane coming to the mills in the latter part of the present season. (*Monthly Bulletin of Agricultural and Commercial Statistics*, May 1918.)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. According to notes forwarded by the Superintendent of Agriculture, plant distribution during the months of May and June from various sources included the following: lime plants, 1,300; yams, 16,960 lb.; eddoes and tannias, 9,843 lb.; sweet potato cuttings, 8,960 lb.; cassava cuttings, 3,298 lb.; horse beans, 1,350 lb.; pigeon peas, 344 lb.; Indian corn, 5,407 lb.; cotton seed (Marie Galante), 1,455 lb., (Sea Island) 457 lb.; coco-nuts, 900; budded oranges, 35; grafted mangoes, 31. In addition, the quantity of plants and seeds raised and used on the Department's Stations for planting purposes, was as follows: yams, 2,230 lb.; eddoes, 700 lb.; various peas and beans, 60 lb. Mr. Moore states that in the Botanic Gardens a large amount of work was involved in the special plant distribution in connexion with the food crops campaign; this has now been completed.

Regarding staple crops, cacao is said to be in bloom, and an early crop is anticipated. Spice prospects may be described as fair. Cloves are selling locally at 16c., 18c, and 20c. per lb. Limes are fruiting well. The crop of nutmegs is good; the price locally is 19c. per lb.; recent London prices ranged from £12 to £15 per barrel. During the June quarter, cotton to the value of £21,885 was shipped to the United Kingdom. Rats and blackbirds are reported as having destroyed sowings of corn. It is understood that the male progeny of the recently imported Berkshires will sell at £5 apiece.

Regarding weather conditions, the rainy season is said to have begun in May. June was calm and rainy. The rainfall recorded at Richmond Hill in May totalled 7·93 inches; for the month of June the precipitation was 10·26 inches.

ST. VINCENT. In his items of interest for the month of June the Agricultural Superintendent, Mr. W. N. Sands, states that good progress has been made with cotton planting. Since the commencement of the season 5 tons of selected cotton seed have been distributed to growers from the Government Ginnery. Indications point to the planting in Sea Island cotton on an area exceeding 4,000 acres. The condition of the young cotton plants was excellent. During the month 584 bales of Sea Island cotton, and 66 bales of Marie Galante were exported. The total crop of Sea Island cotton for the season 1917-18 exceeded 900 bales of 360 lb. each, as against 444 bales for the 1916-17 crop. A scheme for supplying corn meal to small growers who sold cotton or corn to the ginnery or granary has been put in operation.

Special work undertaken by officers of the Department during the month was in connexion with the control of bush bugs and the cotton stainer. The destruction at Government House grounds of Tobago bread-nut trees (*Pachira aquatica*), and the trapping of cotton stainers which had collected on the fruits of those trees were continued. Visits of inspection were made to several estates in connexion with bush bug infestation.

Excellent weather is said to have prevailed during the month. The rainfall recorded at the Botanic Station was 11·7 inches; the register at the Experiment Station showed 9·4 inches.

ST. LUCIA. During the month of June the following plants were distributed: lime plants, 2,350; budded oranges, 6; decorative and ornamental plants, 247; vegetable seeds, 58 packets. Regarding staple crops, Mr. Brooks states that cacao was flowering, limes coming in, and the sugar-cane making good growth. The extension of lime cultivation continues. The scheme of garden improvement at Government House, commenced in April last, has been carried a stage further. Work in connexion with the cacao and lime prize holdings scheme was continued throughout the month. The rainfall recorded at the Botanic Garden, Castries, during the month totalled 8·78 inches; at the Botanic Station, Choiseul, the record was 4·92 inches.

DOMINICA. Plant distribution during the month of June included: limes, 4,325; coffee, 500; shade trees, 150; bamboos, 100; budded citrus, 70; grafted mangoes, 8; miscellaneous, 29, making a total of 5,182. In addition, 120 packets of vegetable seeds were sold. The Curator, Mr. Joseph Jones, mentions the fact that ripe limes were selling at 5*s.* per barrel. The total rainfall for the month was 6·04 inches.

MONTSERRAT. The Curator, Mr. W. Robson, writes to say that comparative drought prevailed during the month of June, and as a result, the first crop of cotton from the breeding plot in the Experiment Station will be small. Plant distribution comprised: Bay plants, 855; sweet potato cuttings, 420; black-eye peas, 3 lb.; Madagascar beans, 4 packets; Lima beans, 7 packets; papaw seed, 2 oz. In the Botanic Gardens seven distillations of bay leaves were made, bringing the total quantity of leaves reaped for the year up to date, to 4,000 lb., with a yield of 46 lb. of oil for the half-year. The return of oil from the last eleven distillations averaged 22 oz. per 100 lb. of leaves. Returns show that the quantity of cotton obtained from the 2,608 acres grown in 1917-18, and delivered to the Government, was 409,511 lb. of lint, being at the rate of 157 lb. of lint cotton per acre, which is 11 lb. above the average for the last fourteen years. The outlook for the present crop has not improved, and in most districts the rainfall has been less satisfactory than at Grove Station. The season, so far, has been the most disappointing, Mr. Robson says, in his experience. In fields of cotton planted in March the bolls have commenced to open, with the prospect of producing half a crop only. Cotton stainers are already reported from a larger number of districts than usual, and leaf-blister mite has appeared in a few cases. Lime cultivation has also suffered on account of the dry weather. In one important lime district, the rainfall for the last ten months totalled 20 inches only. For a similar reason ground provisions are scarce.

Observations made at Blakes and Trants estates appear definitely to connect the existence of certain malvaceous plants, particularly *Sida acuminata*, with the tiding over of the cotton stainer from one season to another. At Blakes it was noticed that the St. Vincent Jack Spaniard, introduced by the Department in 1910, was plentiful. The rainfall recorded at Grove Station during the month was 3·81 inches, making a total of 22·01 inches for the year to date.

ANTIGUA. Mr. T. Jackson mentions that onion seed kept over quicklime since November last in the Experiment Station gave at the beginning of June a germination of 71 per cent., and when planted out in the nursery produced strong seedlings. He expresses the opinion that this method of keeping onion seed for early planting is likely to be a success. Plant distribution for the month of June included 100 lime plants, 2,669 lb. of black-eye peas, 915 lb. of yams, 708½ lb. of cotton seed, 4 lb. of onion seed, and 6 packets of miscellaneous seeds. On the whole, the young cane crop looked promising, but required rain at time of writing. The young cotton crop also looked promising. The returns for last year's cotton crop amounted to 50,151 lb. of clean lint cotton, and 2,221 lb. of stains. Slight attacks of cotton caterpillars were experienced during the month. A silo has been erected at Cassada Garden estate. Approximately 30,000 lb. of cob corn

was shelled and dried at the granary, the operation occupying two and a half days. During the month the peasants were busily engaged in the sowing of cotton and provision crops. In spite of the dry weather experienced, surprisingly good results were obtained from the harvesting during the month of the corn crop planted early in the year. The rainfall recorded for the month was 2·83 inches; for the year, 17·66 inches.

ST. KITTS. In the Botanic Gardens during the month of June the usual routine work was carried out, but all plants, says Mr. Shepherd, are suffering from the prevailing dry weather, and constaot watering is necessary The young cane crop remains in the same condition as that reported last month, consequent on the lack of rain. The position is a critical one, as if heavy rains do not come soon, there will be another short crop next season. Constant tillage keeps the plants green, but there is no growth. The young cotton crop, where established, is looking remarkably well, and only needs showers for development before flowering. Cotton planted in the northern district early in the year gives promise of good returns: picking has begun on some of these estates. The area under cotton for the coming season has been increased about 30 per cent., but the actual figures are not to hand. The total amount of cotton purchased in St. Kitts for the Imperial Government to date is 297,697 lb. At a meeting of the Agricultural and Commercial Society held on June 12, a resolution was passed approving of the proposal of the Government to take measures for destroying food-plants of the cotton stainer, and also for providing a close season for cotton, if the island is divided into districts. The rainfall for the month was 1·74 inches; for the year, 17·74 inches.

AGRICULTURE IN BARBADOS.

To date, the rainfall for the year is about 6 inches less than that recorded at the middle of July last year, but there has been an excellent distribution. The crop of 1917 is now almost a thing of the past. Here and there a red soil estate has closed with an average of 20 tons of cane per acre, but the average of a very large number is 16, 17, or 18 tons. It does seem that a change in the ratooning system is necessary, if a better average is to be obtained. The soil is giving warning that it is unequal to the strain of second or third ratoons, unless it has been very heavily manured, or has been given a period of rest. The seedlings which are now grown will not develop as ratoons, unless the soil is up to mark. At this time there is also the shortage of artificial fertilizers to be reckoned with, but even these cannot be substitutes for conditions which are essential. The warning that rotation and rest are needed has been so far a mild one, and time is being given to establish a system scientifically correct, the neglect of which may possibly result disastrously.

It should be remembered that an important effect of rotation is the resting of the various layers of the soil. For instance, corn sends down its roots deep into the ground, and so derives much of its sustenance from the subsoil. Rotation also exerts a beneficial effect on the soil in two ways. The preparation of the land for each crop, through the turning over of the soil, causes exposure to the atmosphere, and we know the effect of this. Next, the rotting of the roots of former crops makes the soil more porous, and the atmosphere is able to exercise its fertilizing effect not only on the surface but also on the subsoil. Other cane growing countries have suffered from neglect of the fundamental laws of agriculture. There is no charm which can ward off similar results here if similar causes exist.

We are informed that the output of the factories will be smaller this year than last, and it will be remembered that last year's tonnage was much below that reached in 19·6. This is due to some extent to the smaller crop, but more to the highly remunerative price of syrup. Except in those cases where factory owners are also the owners of large areas of land, the position of factories will be precarious unless co-operation takes the place of the present system of isolation.

It would appear that in the black soil all the provision required under the Vegetable Produce Act has been planted. In the red soil some progress is being made, but in a large number of cases such work has been delayed through insufficiency of labour to get through both the reaping of the crop and the tillage necessary for planting.

Corn, we observe has grown very much better than last year, and the development of some fields has been most satisfactory, particularly where a crop of fall potatoes had been reaped a few months previously.

We notice that a good many peasants in St. Philip's parish have recently planted their holdings in cotton. They have acted wisely. Soil and weather conditions in this part of the island are admirably suited to the growth of this plant. (The Barbados *Agricultural Reporter*, July 13, 19·8.)

COMMERCIAL POSSIBILITIES OF PARA RUBBER SEED.

In the *Agricultural Bulletin of the Federated Malay States*, February 1918, an account is given by Messrs. F. G. Spring and F. W. F. Day of experiments conducted by the Department of Agriculture, Federated Malay States, and the Imperial Institute in order to throw some light on the above subject. The following is the summary of the conclusions reached.

At the beginning of the present experiment in September 1916, a consignment of 30 tons of Para rubber seed was sent to Hull for crushing and valuation. The oil realized £50 per ton, and the residual cake £8 per ton, the price of linseed oil being then £60 per ton. These figures show beyond doubt the unquestionable value of the oil, and it would appear that as soon as the new product has acquired the confidence of the oil market, it will occupy a place but little inferior to linseed oil. Though Para rubber seed oil is a drying oil, it dries less quickly than linseed oil, and is therefore inferior to the latter for certain industrial uses. When linseed oil is high in price, however, it has to be replaced by oils that are intrinsically inferior to it for these purposes, and among these substitutes Para rubber seed oil takes a high place.

Much might be written of the enormous possibilities of Para rubber seed oil, but it is sufficient to point out that this high grade oil requires hardly any refining, is obtained from a waste product available in great quantity, is easy to collect, transport, and store, and can be readily crushed. Although it would pay well in normal times to ship the seeds, yet under restricted freight facilities it would seem that shipping the oil is more advantageous. Moreover, oil keeps far better than seed, and is more conveniently stored.

Finally, the production of rubber seed oil would not interfere with the market for coco-nut oil or other vegetable oils used essentially as human food in the form of margarine and cooking fats. These are never used for paint, varnishes, and such like purposes.

WATER-LILIES IN ST. VINCENT.

The following interesting notes on the above subject are contributed by Mr. W. N. Sands, the Agricultural Superintendent in St. Vincent:—

All the streams in St. Vincent are swift, running from mountain to sea, and the coastal lands are well raised above sea-level, consequently there are no swamps. Owing also to the light volcanic soil, ponds retain water for short periods only, with the result that there are few striking flowering water plants. Attempts to introduce these plants into pools in rivers have not been successful, because the pools are so frequently washed out during heavy rains. As far as the writer is aware, the water-lily (*Nymphaea ampla*) is found only in one small pond in the colony, and this dries up after the rainy season every year. Sporadic efforts have been made from time to time to grow aquatic plants in gardens, but these have not been viewed with favour by the sanitary authorities, owing to the fact that the tanks or tubs often served as breeding places for mosquitoes. This disability, however, can be easily remedied now that a permanent source of supply of the 'millions' fish (*Girardinus poeciloides*) is maintained in the Botanic Gardens.

In the year 1915 a large circular concrete basin or pond, 30 feet in diameter and 2 feet deep, was constructed in the gardens, in order that water plants, more particularly the true water-lilies of the genera Nymphaea and Victoria, might be cultivated. With the idea that a short account of the experience gained in the growth of certain of these might be of interest to others in the West Indies, these notes have been written.

The water-lilies, with the exception of the *Victoria regia*, are grown in tubs 14 inches high. Cement barrels sawn in half have been found suitable for the purpose, as they do not readily rot under water. Even strong-growing nymphaeas will thrive and flower freely in these tubs without it being found necessary to transplant them. Other advantages are: (a) the water of the pond can be kept fresh and clear, and free of decaying vegetable matter, and (b) the growth of individual plants can be controlled.

In preparing tubs for planting, holes are bored with a large auger in the bottom of each, as well as around the sides, about 3 inches from the base. To insure proper drainage, a layer of stones or broken crocks is placed inside the tubs, covering the holes, and on this is placed a layer of rotten wood. The soil mixture or compost used consists of good loam, cotton-seed meal, and wood-ashes, in the proportion of 10: 2: $\frac{1}{2}$ by volume. This has given excellent results, and it has not been uncommon for a single plant to produce eight or nine flowers at one time, some of which have exceeded 12 inches in diameter. Before the cotton-seed meal and wood-ashes were used, green filamentous algae, known as 'moss', produced very unsightly effects in the pond each spring. Copper sulphate might perhaps have been used to control the algae, but for various reasons it was considered inadvisable to use it. Whether it was a mere coincidence or not has not been ascertained, still the fact remains that after using the above mixture the algae disappeared completely, and gave no further trouble. It may be added that other rich soil composts could be used for the tubs, or varied to suit particular circumstances.

When planting the different kinds of nymphaeas, small plants are selected from those which have grown up around the old flowering heads. Suckers were usually produced in considerable numbers in the *N. Lotus* and *N. tuberosa* hybrids and varieties that have been grown. One young plant of strong-growing kinds, and two or three of those less robust, are set in each tub just before it is submerged. Small tubers may also be used, especially of those varieties that have a distinct resting period each year even in presence of an abundant supply of water and a slight fall of a few degrees only in temperature.

For the *Victoria regia*, a bed is formed in the centre of the basin with the same soil mixture as described above. The soil is kept in position by means of a circle of large stones built up to the requisite height of 14 inches; this, as in the case of the nymphaeas, allows of a maximum depth of water of 10 inches covering the soil, which is ample. Seedlings of the lilies are raised annually from seed produced in the pond, and one of these is planted in the bed.

The plants must be fully exposed to sunlight, and sheltered from high winds. They require little attention subsequently, but it is necessary every week to take off exhausted or damaged leaves and flowers, in order to keep them in good healthy condition.

The raising of new kinds of water-lilies is quite easy, and repays attention. Our experience has hitherto been confined to the raising of hybrids between *N. Lotus* and *N. tuberosa*, and we have already obtained some beautiful forms. These two species were selected, because (1) the diurnal movements of the floral organs were practically identical, and gave most promise of early success, and (2) because only a small number of seedlings could be tested at one time. It may be explained that certain groups of nymphaeas flower by night, and others in the day. For example, the flowers of *N. Lotus* and *N. tuberosa* begin to open after dark, remain fully open all through the night, and commence to close soon after sunrise. They are quite closed by 10 a.m. Again *N. zanzibarensis* starts to open about 9·30 a.m., remains fully open all day, and closes about 6 p.m. A variety of this species, *N. zanzibarensis*, var. *rosea*, commences to open soon after sunrise, and closes about 5 p.m. Apart from the question of raising seedlings, it is important to note that unless the pond is visited before 10 a.m., or by moonlight, *N. Lotus* and *N. tuberosa* are not seen with open flowers, whereas the full beauty of *N. zanzibarensis* cannot be seen until after 10 a.m.

The flowers are frequented soon after sunrise by the honey-bee (*Apis mellifera*). This is the chief insect visitor observed. Night-flying insects have not yet been seen on the flowers. The honey-bee does not confine itself to visiting flowers of one colour only, but has often been noticed to collect pollen from white, pink, and red flowers in succession. It is this fact which renders common the production of natural hybrids.

Owing to the limited facilities for handling seedlings, the practice is to allow only one or two flowers on selected plants to mature seed. All the other flowers, as soon as they have faded, are taken off. It is often difficult to ascertain when the fruit is ripe, for after flowering the flower-stalk bends outwards and downwards, and submerges the fruit, which ripens under water, or rather, gradually decays. When sufficiently decayed, the seeds are liberated. To each seed is attached a spongy mass of tissue filled with air, by means of which the seeds are enabled to float, and are dispersed over the surface of the water. After a few hours the tissue loses the air, and the seed sinks. Some days later, provided the conditions are suitable, the seed germinates. The *Victoria regia* bed in the centre of the pond provides a suitable nidus, and it is usually possible to obtain an adequate number of seedlings from this source for testing purposes. At a very

early stage seedlings can be recognized in respect of reds and whites, and there is in the species described a correlation between leaf and flower colour—that is, seedlings which will produce pink and red flowers have reddish-brown leaves of different shades, and those which will produce white flowers, green leaves. The distinction is noticeable in the first rosulate, sagittate, submerged leaves of the seedlings, and is very pronounced in the earliest floating ones. Seeds can of course be collected, and sown in pots or boxes under water, if so desired.

On one occasion a fruit of a Zanzibar lily, from which seed was specially desired for sowing, liberated its seed before it could be secured, and fortunately no other seeds were being germinated in the pond at the time. After a few days a large number of small seedlings, possessing one minute leaf and one or two fine roots only, with the seed still attached to the little plant, were discovered in various places. The seedlings were so small—less than ½-inch long—that they were difficult to handle. A novel method was devised in order to transplant them into boxes. The boxes were filled with sandy soil, and submerged in the positions they were to occupy. Then some clay was obtained, and rolled into small balls about the size of a playing marble. Each small seedling was then placed in the ball of clay, leaving only the small leaf exposed. The seedlings with their clay 'sinkers' were then planted in the soil of the boxes under water, at distances of about an inch each way. This method proved successful, and the seedlings were successfully established.

When floating leaves have been formed, the selected seedlings are transferred to boxes large enough for them to produce a few flowers in. These boxes can be made conveniently out of the ordinary kerosene box, by sawing it in half, and boarding up the sides cut through. These boxes are prepared for the plants in a similar manner to that described in the case of the tubs. The seedlings will 'declare' themselves in a few months, and then if they prove to be of sufficient interest, they can be propagated vegetatively in the manner already described. The fact that most water lilies can be reproduced by vegetative means eliminates the difficulties usually met with in fixing hybrid plants that have to be grown from seed.

For the amateur with limited facilities it is suggested that a start might be made with the nymphaeas named below; these are easy to grow, are robust, flower freely, and have not been found susceptible to disease:—

N. Lotus, var. *dentata*	Large pure white
N. hybrida	Large light pink
N. tuberosa, var. *rosea*	Bright deep pink
N. zanzibarensis	Intense blue
N. zanzibarensis, var. *rosea*	Heliotrope
N. 'William Stone'	Blue

The above-named lilies give charming floral displays. Several others might be named, and the list added to or modified, but, at the outset, most growers will find that these will meet their requirements.

Although the parentage of natural hybrids from probably impure varieties is always open to question, and cannot be exactly given, yet several excellent hybrids have been raised; among these are a fine white one, named 'Rena Sands', and two large and distinct maroon forms, to one of which has been given the name of 'St. Vincent'. These are merely mentioned here to indicate that, with even a few good varieties, striking novelties can readily be obtained, which adds much interest to the culture of these beautiful flowering plants.

DEVELOPMENTS CONNECTED WITH THE CO-OPERATIVE PURCHASE OF COTTON AND CORN IN ST. VINCENT.

A further example of the value of co-operative work in agriculture to the small grower is exhibited in some recent developments connected with the co-operative purchase of cotton and corn at the Government Ginnery in St. Vincent. Mr. W. N. Sands, Agricultural Superintendent in that island, in forwarding the information below, remarks that the small grower of cotton usually requires all his available ready cash for planting his land, so that if he can obtain corn meal for food, and seed for planting, on credit, he is encouraged to do his best in improving his cultivation with the resources at his disposal.

During the 1917-18 season 1,427 passbooks were issued to growers selling seed-cotton to the St. Vincent Government Ginnery and Granary on a profit-sharing basis, and 346 to those selling corn, making a total of 1 773, many of which contained several entries. The transactions connected with the purchases are not yet complete, so that the actual figures are not available, but approximately the sales amounted to 223,920 lb. of Sea Island seed-cotton; 132,000 lb. of Marie Galante, and 147,840 lb. of 'wet' grain corn.

In order that the sellers of both cotton and corn might obtain kiln-dried corn meal for home consumption at a time when local foodstuffs were comparatively scarce and dear, and during the period when planting operations were in progress, a new scheme was inaugurated in June last at the granary under which any person who sold cotton or corn to the amount of $6·25 and $5·00, respectively, might obtain on credit 25 lb. of corn meal at the rate of 5c. per lb., on the security of his prospective bonus. These were the minimum amounts for which corn meal was issued, but larger quantities could be obtained in proportion to the value of the sales made.

The scheme is working well, and is likely to have an excellent effect on the growing of both cotton and corn by the peasantry in the colony.

For the past two seasons it has been possible for the small grower to obtain on credit at the ginnery all the cotton seed he required for planting. This had a most beneficial influence, because it practically assured the planting of seed from a selected strain of good ordinary Sea Island cotton, and greatly facilitated the grading of the cotton when offered for sale.

Grape Culture in South America.—*The Times* Trade Supplement, June 1918, in an article on the industries of South America, draws attention to the fact that grape culture both in Argentina and Chile is an industry of great commercial importance.

In Argentina the grape is very extensively cultivated in the neighbourhood of the town of Mendoza, where an extensive system of irrigation has been introduced by the damming of a river which flows down from the Andes. A marvellously fertile district has thus been brought into being, from which enormous quantities of wines of essentially sound character are produced. These wines, however, are seldom kept long enough to mature thoroughly.

Chile is admirably adapted for grape cultivation. It specializes in the quality of its wine which is unusually fine, many growths challenging comparison with any of the average vintages of the famous wine-producing countries of Europe.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* / Rev. C. H. Branch, B.A.
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Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

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*Seconded for Military Service.
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NOTES AND COMMENTS.

Contents of Present Issue.

The benefits which the science of plant physiology renders to agriculture is the subject of the editorial.

Some recent applications of entomologists' researches in the control of mosquitoes will be found under Insect Notes, on page 234.

An interesting article on the production of hybrid water-lilies in St. Vincent appears on page 230.

The distinguishing characteristics of the two West Indian species of the cabbage palm are described on page 237.

'West Indian Bulletin', Vol. XVII, No. 1.

The first two papers in this number of the *West Indian Bulletin*, which has just been issued, are by the Mycologist and Entomologist attached to this Department, recording respectively their investigations on internal disease affecting cotton bolls in St. Vincent, and of the insects which are connected with its spread. The first of these papers, by the Mycologist, is referred to in another column of this number of the *Agricultural News*. The third paper is a statement by the Agricultural Superintendent, St. Vincent, on the beneficial results obtained by measures adopted to control the cotton stainer, and the fourth is a record of results obtained also by him in trapping the cotton stainer in that island. Some notes on the thymol content of horse-mint and ajowan seed, obtained after analyses made by him in Antigua, are given by the Acting Government Chemist and Superintendent of Agriculture for the Leeward Islands in the fifth paper. The last paper contains some observations on fish poisoning in the British Virgin Islands, by Dr. Clarke, the Medical Officer of that Presidency.

Unusual Weather in Dominica.

Mr. Joseph Jones, the Curator of the Botanic Station, Dominica, reports that on the night of July 11, a squall of considerable violence was experienced on the south and south-west coasts of that island. In Roseau, for about twenty minutes between 9·45 and 10·30 p.m., gusts of almost hurricane force came from the south. The Botanic Garden is fairly well protected on that side, and suffered only slight damage, but at the Experiment Station a few lime trees were blown down.

There has been some loss of lime trees, with a considerable loss of immature fruit, on the south and the south-west coast estates. On the north of the island the wind was scarcely felt.

For the three days before this unusual storm was experienced the weather had been unsettled, the rainfall at the Garden during that period being 5·32 inches.

The Profitable Cultivation of Ground Provisions.

A note in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, Part 1, issued June 17, 1918, gives actual figures of some results obtained during the past season in the cultivation of ground provisions. Now that so much attention is being given to this question, it is important to emphasize the advantage of intensive cultivation. Many cultivators attempt to work a large area in poor fashion, and get correspondingly poor returns, whereas, in many cases, from the same labour and expenditure on a smaller area, larger profits would be obtained.

Mr. A. B. Carr, of Caparo, planted on ⅛-acre 250 lb. of yams in well prepared trenches, and reaped 5,030 lb. The total expenditure was $19·50, being $7·50 cost of yams for planting, and $12·00 cost of cultivation. The value of the crop at 3c. per lb. was $150·90, showing a profit on the ⅛-acre of $131·40.

On a similar small plot Mr. W. S. E. Barnardo, of Tamana, with an expenditure of $18·70 on cultivation, obtained crops to the value of $86·45, leaving a net profit of $67·75. Mr. Barnardo's crops were the following: 3,690 lb. of yams at 2c. per lb.; 200 lb. of Chinese tannias at 1c. per lb.; 100 lb. of cush-cush at 3c. per lb.; 165 lb. of pumpkins at 1c. per lb. Mr. Barnardo states that the yam crop was poor compared with that of the previous season, owing to excessive rain in May and June.

As an example also of the way in which ground provisions may be profitably cultivated on larger areas, the following is the result obtained by Mr. L. Sebeult, River estate, Department of Agriculture, in growing catch crops, mainly in establishing permanent cultivation of the following plants: 500 limes, 100 mahogany, 4,000 cedar, 8,000 coffee. He reaped 19,000 lb. of yams worth $540, at 2½c. to 3c. per lb.; 72,000 lb. of tanias worth $1,440, at 2c. per lb.; 100 barrels of corn worth $175, at $1·75 per barrel; and $100 worth of cassava, peas, ochroes, pumpkins, and cucumbers; making a total return of $2,255, at an expenditure of $1,100, showing a net profit of $1,155. The above expenditure included the cost of planting and cultivation of the permanent crop, but not the cost of the plants themselves.

Forestry in Trinidad.

In the editorial in the last number of this Journal, reference was made to the fact that in Trinidad alone of these West Indian islands was forestry being carried out on scientific lines. In the *Proceedings of the Agricultural Society of Trinidad and Tobago*, May 1918, the following figures, taken from the Report of the Forest Officer for the year 1916, are given of the number of the principal species of trees which are being grown in the forest plantations There are: 62,993 cedar, 42,355 cypre, 10,325 balsam, and 14,353 teak trees growing in the plantations at present. The Forest Officer states that the trees are not less than 10 feet apart, and that, including other valuable species, there are over 140,000 trees in the plantations.

The East Indian teak (*Tectona grandis*), the seeds of which were obtained from Burma in 1913, continues to do well. Many of these trees have now attained a height of from 40 to 50 feet, and a girth of 2½ feet at 5 feet from the ground. The Forest Officer thinks that the growth of the teak in Trinidad is equal to that in any part of the world, and some 4,000 seeds collected in the last year will be further sown in the plantations. In each locality where these trees are planted, the original forest containing no marketable timber of any consequence, was felled, burnt, and lined out with stakes at 10 feet by 10 feet.

It is estimated that the yield in 100 years will be 240 tons of about 50 cubic feet of first class wood per acre, the present price of which is £50 per ton, although the normal pre-war price averaged £25 per ton. Teak is one of the most valuable timbers, much employed in shipbuilding, and for other purposes where durability is required.

Are Anopheles of Non-Marshy Districts Capable of Transmitting Malaria?

In a notice of an article by M. E Roubaud in *Comptes Rendus des Séances de l' Academie des Sciences*, September 17, 1917, published in the *Agricultural Gazette of Canada*, May 1918, the result of the author's personal investigations of the subject is given.

It is stated that in spite of the continuous presence of *Anopheles maculipennis* in certain reclaimed districts of France which were previously marshy, malaria has not reappeared to any marked extent. This fact has given rise to the supposition that the extinction of the disease may be connected with a sort of natural immunity of the mosquitoes concerned To settle the point, patients under treatment for malaria at the Pasteur Institute at Paris were caused to be bitten by perfectly healthful anopheles taken in the town, and it was proved that these mosquitoes were infected with the malarial parasites. The author, who was perfectly healthy, then allowed himself to be bitten by one of the infected mosquitoes. Fifteen days afterwards the fever appeared, preceded a few days previously by exhaustion; on the next day the sporazoites which are known to cause tertian malaria fever were located in his blood.

It is therefore evident that *Anopheles maculipennis* of the Parisian non-marshy districts is in no wise an immune species, and is perfectly capable of transmitting malaria. It is indeed highly improbable that any such immune species of anopheles exists.

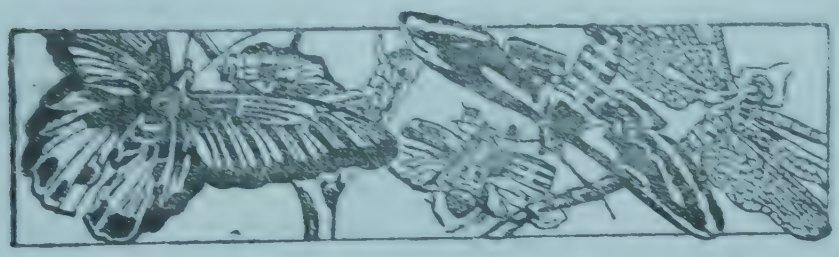
Rubber Substitutes.

An article in the *India Rubber World*, July 1, 1918, by M. André Du Bosc, a distinguished French chemist, on the preparation of rubber substitutes, gives much information on the subject.

The action of metalloids like oxygen and sulphur, of certain chlorides like chloride of sulphur, and of acids like nitric acid, on vegetable or animal oils, produce new bodies of which the physical and chemical properties differ absolutely from the oleaginous substances from which they have been derived. Because of their physical resemblance to rubber, these products are called rubber substitutes.

The chemicals most frequently employed in preparing commercial rubber substitutes with different kinds of oils are sulphur, and chloride of sulphur

In principle, all vegetable or animal oils may be used; nevertheless experience has proved that certain drying oils like that from linseed are preferable. However, non-drying vegetable oils like castor oil may also give an excellent rubber substitute. Finally, since the war, fish oils have also been used.



INSECT NOTES.

ENTOMOLOGY IN RELATION TO DISEASE, HYGIENE, AND SANITATION.

During May last, a very important and interesting movement was started by members of the Staff of the United States Bureau of Entomology at Washington, D.C.

This was the formation of a class for the study of the Entomology of Disease, Hygiene, and Sanitation. The object of this class, and the method of procedure were explained in a memorandum prepared at the request and for the approval of Dr. L. O. Howard, Chief of the Bureau. In the minutes of the first meeting of the class these were summarized briefly, as follows: 'There is a possibility of the Army here (in the United States) and abroad calling upon the entomological profession to furnish before long a large number of men informed on the subject of disease-transmitting insects, and the methods of controlling these insects. It is intended, therefore, by means of this class, and through correspondence with field men, to prepare as many as are willing to undertake such work.'

It was arranged that the class should meet for one hour per week, or oftener if conditions warranted it, and that a collection illustrating the various aspects of the work should be made. A class leader and a secretary were chosen. The duties of the leader are to give or to provide for a twenty minutes talk at each meeting, which should be followed by discussion, all of which was to be recorded and mimeographed for subsequent reference and use.

This class organization has met with favour, the attendance at the meetings has increased, and the members who have joined by correspondence have also increased in numbers.

The problems to be dealt with relate particularly to the diseases of army camps and their surroundings, and include the hygiene and sanitary conditions of towns and cities, especially those which are in any way connected with such camps, either by their proximity or because they are sources of food supplies for them.

Dr. W. Dwight Pierce, the class leader, recently visited the Marine Camp at Quantico, Virginia, and his account of this visit is likely to be of interest to readers of the *Agricultural News*, since he records some simple and apparently efficient devices for mosquito control. A review of the subjects dealt with at the class meetings would also be of interest, but as these are intended, first of all, for the use of Army and Municipal sanitarians, rather than for application to conditions such as those existing in the West Indies, they will not be further dealt with at the present time, but will probably be referred to later.

Dr. Pierce found at Camp Quantico an excellent entomological organization attached to the Post Surgeon's office, the work of sanitation having been organized by Lieut. Ebert who is directly in charge of this work.

The largest problem in the sanitation of this camp was found to be mosquito control, on account of the fact that there are boggy places in the camp, and large swamps adjoining, along the Potomac River.

The work of mosquito control falls under three heads: ditching, clearing vegetation from the banks of the ditches, and the application of insecticides.

The most interesting of these operations were those concerned with the application of insecticides, and it is to this phase of the work that attention might be directed in the West Indies.

Crude oil is the larvicide used at the camp. It is not applied by spraying on the surface of the water in the usual way. Dry sawdust is saturated with crude oil, the proportion being about 30 per cent. of oil and 70 per cent. of sawdust.

This mixture is used in a variety of ways. The detailed squads in charge of insecticide application carry with them on their rounds quantities of this oil-saturated sawdust, sprinkling a handful of it on each small breeding hole they find. Even a few sawdust particles dropped in a small puddle of water will quickly form a film of oil which will remain for a long time.

In streams of running water, cross booms consisting of two small boards or sticks fastened together, and anchored to form a V on the surface, are used to hold up a quantity of saturated sawdust. These are arranged so that the oil which is liberated from the sawdust passes between the ends of the sticks in the middle of the stream, or around the ends towards the stream bank, and a film of oil is thus provided on the surface below the boom. A series of these booms placed at intervals has been found to check mosquito breeding almost altogether. A modification of this idea, which was also successfully used, consisted of a box filled with oil-saturated sawdust. Two sides of this box were screened, and it was fixed in the stream. The water flowing through the box carried with it a small quantity of oil.

This idea would seem to be capable of application in the West Indies in many places where mosquitoes have been found difficult of control.

Sawdust saturated with crude oil would be easy to transport and to apply, and by means of the boom or screened box it ought to be possible to treat small or even fairly large streams of running water; and in the case of swamps and large bodies of water it ought to obviate largely or entirely the difficulty which arises from the crude oil not spreading properly when sprayed on, and to overcome satisfactorily the drawback due to the rapid evaporation of the oil on the water under the influence of the tropical sun.

In many places sawdust is available for trials of this idea; in others, substitutes will be found by anyone who really wishes to carry out an experiment. It would seem that coco-nut husk might be useful in this connexion, and there are probably many native substances which need only to be tried in order for something to be found in any locality suitable for the purpose.

H.A.B.

CAMPAIGN IN JAMAICA AGAINST HOOKWORM.

A leading article in the Jamaica *Gleaner*, June 14, 1918, draws attention to the arrival in Jamaica of Dr. M. E. Connor, one of the officers of the Rockefeller Foundation, which has been combating the hookworm disease in the United States and neighbouring tropical countries.

One of the first efforts made by the recently founded Jamaica Imperial Association was to bring to the attention of the local Government the need of taking advantage at once of the Rockefelloer Foundation's offer to treat hookworm in the

island, provided the local Government would find the funds necessary for the purchase of drugs and stationery, and would also undertake to make the necessary arrangement for permanently improved sanitation, without which the treatment of individuals would represent a waste of energy and money. As soon as the Legislative Council met in their present session, a deputation of members of the Jamaica Imperial Association urged upon the elected members the vital necessity of the Council availing itself of the Rockefeller Foundation's offer. A resolution was brought forward in the Council calling for immediate action in this matter. The Government accepted the resolution, placed £2,000 on the estimates for the drugs and stationery that would be required in the first year's campaign, and promised that not only hookworm, but other germ diseases would be dealt with in the near future. Since then the Council has passed a law for the compulsory treatment of venereal diseases, while the abnoxious disease of yaws is to receive far more attention than it has ever received before. The *Gleaner* remarks that this may be called the beginning of a remarkable revolution in the health of the island. The Jamaica Imperial Association, the Legislative Council, and the Government are to be congratulated on the prompt steps taken.

Dr. Connor intends to make a preliminary survey of the island, so as to be able to strike an average of what percentage of the people may be infected with the hookworm parasite in the different districts. In parts of the island where there may be better sanitation, it is not probable that a large percentage of the people will be found infected, but where sanitation is neglected, there is probably a very large percentage.

If anyone had been told ten years ago that 'West Indian laziness' was largely a disease caused by microscopic blood-sucking parasites, the suggestion would have been laughed at. We know now, however, that the microscopic hookworm, boring into the arteries of human beings, sets up internal bleeding which leads to a wretched state of health, and thus produces the lassitude and want of energy in a large proportion of the inhabitants of these islands, which had been formerly attributed to the enervating influence of a tropical climate.

DIFFERENT VARIETIES OF BAY TREES.

The manufacture of bay oil and bay rum constitutes two important industries in some of the West Indies, having been developed chiefly during the last fifty years.

A note on the subject in the *Kew Bulletin*, No. 4, 1918, points out that the industry has suffered much from the admixture of the leaves of two forms of *Pimenta acris*, which are known in the French islands as 'Bois d' Inde citronelle' and 'Bois d' Inde anise', which are so similar as to be distinguished with difficulty. 'Bois d'Inde citronelle' is known botanically as *Pimenta acris*, var. *citrifolia* (P. citrifolia, Myrtus citrifolia); the oil of this has the taste and odour of lemon, owing to the presence of 'citral', which reduces the value of the true bay oil if mixed therewith. 'Bois d' Inde anise' does not appear to have been distinguished botanically, but its oil also is an equally undesirable product, which reduces the value of bay oil. The true economic plant is known as 'Bois d' Inde', or in English, the bay tree. The presence of the leaves of the other two varieties amongst produce sold as true bay leaves is not only a matter of considerable inconvenience and possible loss to distillers of bay oil, but tends to give a bad name to samples of such mixed oil when put on the market.

Leaves and flowering branches of all three forms have been submitted to Kew by Mr. J. Jones, Curator, Botanic Garden, Dominica, with a view to the detection of any botanical characters by which they can be distinguished, but the principal difference detected is in the fragrance of the bruised leaves; that of the 'Bois d' Inde citronelle' being citron-scented, while the others are simply aromatic, a character difficult to utilize in collecting leaves from wild sources. Moreover, it fails in differentiating the 'Bois d' Inde anise', and it is not yet clear why this particular variety fails to reach the desired standard as regards its essential oil. The specimens have been subjected to botanical comparison, and to more detailed examination in the laboratory, but no conspicuous differences have been observed.

Mr. Jones remarks that the three varieties have been cultivated in the Botanic Garden for fifteen years, and that they were obtained as representing the true varieties. The differences observed are thus defined: 'The "Bois d'Inde citronelle" is possessed of a lax growing habit, which is quite distinct from the compact erect habit of the "Bois d'Inde anise". The appearance of "Bois d'Inde" approximates that of "Bois d'Inde anise," but is less compact. The cymes of "Bois d'Inde citronelle" are longer than those of "Bois d'Inde anise", and several times larger than those produced by the true "Bois d'Inde." '

Fruiting specimens are not yet available. Any differences here, however, if they exist, would be of no practical value as a guide in gathering the leaves before the fruits are developed.

At present the leaves are collected from the wild plants in several islands, including Dominica, Porto Rico, and the Virgin Islands; while in Montserrat there is increasing interest being taken in the cultivation of the trees. It is suggested therefore, that wherever the plant is being brought under cultivation, steps should be taken to ensure that the plants selected have been derived from a pure stock of true *Pimenta acris*.

This case of varietal forms of *Pimenta acris* affords a parallel to those of camphor (*Cinnamomum Camphora*) and chicle gum (*Achras Sapota*). Of both these plants more than one form is known to exist, and the present instance affords yet another example of the absolute necessity of making sure of the value of any particular strain or physiological form of an economic plant, before establishing plantations on an extensive scale.

Mr. Jones states that *Pimenta acris* in its three varieties exists in great numbers on poor soils near the coast.

When the lemon-scented pimento was brought to the knowledge of Kew some thirty-five years ago, the plant was propagated, and between the years 1885 and 1889 there were distributed many seedlings to Jamaica, Demerara, Lagos, Queensland, Fiji, Ceylon, Java, and Singapore.

DEPARTMENT NEWS.

Mr. W. M. Malins-Smith has resigned his office of Agricultural Instructor on the Staff of the Agricultural Department, Grenada, in order to take up the appointment as manager of the estates of the heirs of the late Mr. George Patterson. In accepting Mr. Malins-Smith's resignation as from the 31st inst., His Excellency the Governor of Grenada expressed his appreciation of the efficient and conscientious work performed by Mr. Smith in the public service.

GLEANINGS.

A correspondent of the Jamaica *Gleaner*, June 11, 1918, states that the pimento crop will be very poor this year, owing to the continuous rains, although the price is pretty good. He also states that in some parts of the island, if the heavy rains continue, a large proportion of corn will be spoilt.

More than $7,000,000 was paid out by the Hawaiian plantations in bonuses to labour during 1917, according to figures just completed by the Bureau of Labour and Statistics of the Hawaiian Sugar Planters' Association. The rate of bonus was 78 per cent. (The *Louisiana Planter*, June 29, 1918.)

The *Louisiana Planter*, June 29, 1918, draws attention to the labour difficulty in Louisiana. It is stated that in some parts of the State there is hardly enough labour available to harvest the corn crop, and to harvest the cane crop requires about thirty times more men than the corn harvesting does.

Botanists will be interested to know that the botanical collections and the library of the Boissier Herbarium have been presented to the University of Geneva by the children of the late Madame Barbey-Boissier, who have made arrangements that this valuable collection shall remain accessible to the scientific world.

Dr. George V. Perez, in referring again to the extraordinary vitality of Bougainvillaea root cuttings, says that some of his are still alive, although they have been out of the ground for eighteen months. He rightly considers that these cuttings would be a very convenient way for sending Bougainvillaea plants far and wide for striking them afterwards.

The Jamaica correspondent of *The Times* writes in the Trade Supplement of that Journal, June 1918, that the demand for Jamaica honey is exceptionally great. The price has jumped from a couple of shillings almost to 20*s*. per gallon. In view of the shortage of butter, and the restrictions on sugar, a considerable increase of the industry appears to be likely.

The International Sugar Committee has issued a circular, dated June 27, 1918, in which the following resolution of the Committee is brought to the notice of the seller and all parties to the agreement as to Cuban sugars, 1917-18 crop, to the effect that the International Sugar Committee avails itself of the option to purchase a second additional 250,000 tons of sugar, as provided for in paragraph 4 of the agreement referred to.

From *Documentary Leaflets* of the International Institute of Agriculture, Rome, for May 1918, it appears that the demand for the vegetable fibre produced in the capsules of *Bombax malabaricum* is continually increasing, and it may be accepted on the market as true kapok. The Annamese are becoming more interested in this product, and collect it, though they take very little care of it, and are apt to ask high prices. This industry is capable of rapid development, as the Bombax tree grows quickly, and bears in a very few years.

Ample scope exists in Jamaica for British investors in the direction of the development of coffee, cacao, and sugar, and of other industries, but it is noteworthy that while Americans and others are turning their attention to this island, and are acquiring properties for the purpose, the British capitalists have so far not shown much enterprise. Possibly this is due to war conditions; but it is hoped that the British investor will not forget the warm welcome that awaits him in this the second oldest colony of Britain.—(*The Times* Trade Supplement, June 1918.)

In addition to the two concrete corn bins erected last year, the Trinidad Government has erected at the Government Farm, St. Joseph, two concrete silos to hold about 150,000 lb. each of black-eye peas, corn, or other perishable crops. These will be available this year for food crops, and with the return to normal conditions be used as silos. An existing building at the farm has also been altered slightly, so that fumigation can be done in it, and it is estimated that this will hold about another 200,000 lb. of peas, etc. The total storage room will amount to about 650,000 lb. (The *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, Part 1.)

A letter received by the Imperial Commissioner of Agriculture for the West Indies from the Adjutant-General of the State of New York encloses a General Order of March 23, 1918, which shows that it is the policy of the Military Department of the State of New York to assist in every way in guarding against an international food shortage. The General Order states that in order to assist those engaged in agricultural pursuits, Commanding Officers of the New York Guard are directed to excuse from attendance at drills those members of their commands who are actually engaged in civil life in farm labour, whenever their attendance at drill would interfere with their agricultural employment

Under the administration of the Department of Agriculture and Technical Instruction for Ireland, according to a circular issued by that Department, dated May 1918, the production of food in Ireland, especially food exported to Great Britain, has for several years past been steadily growing. The value of food and drink stuffs imported into Great Britain from Ireland and retained for consumption there in 1913 was £36,000,000, only exceeded in that year by the value of the imports of the same articles from the United States, which was £39,000,000. Since the war the supply coming from the United States has abnormally increased, amounting to the value of £116,000,000 in 1916. The Irish supply, though not in this proportion, has gone on increasing during these years also, the value of this in the same year, being £59,000,000.

THE EFFECTS OF ULTRA-VIOLET RAYS ON PLANTS.

As is well known, in the spectrum of sunlight there are seven visible colours, red, orange, yellow, green, blue, indigo, violet, which are visible to the human eye, but besides these, on each side of the spectrum there are invisible rays known on the one side as ultra-red, which are heat rays, and on the other side ultra-violet, which are chemically active. These ultra-violet rays vibrate so many million times a second that our eyes are blind to them, just as our ears are deaf to the most rapid vibrations of sound. But these invisible rays which are recorded on photographic plates have a strong chemical effect on plants. They are very quickly absorbed by the atmosphere, and only a comparatively small part of these rays given off by the sun reaches the earth's surface. An interesting paper by Taizan Tsuji, in the *Louisiana Planter*, June 29, 1918, records some experiments made by him on the stimulating effect on the ultra-violet rays on some tropical crops.

In one experiment, germinated sugar-canes were planted in moist soil, and cultivated in the dark at a temperature of about 22°C. The plants grew, but naturally turned pale. After thirty days these etiolated plants were divided into two groups, one of which was exposed to sunlight, while the second was exposed to the ultra-violet rays produced by a quartz mercury-vapour lamp. After two hours and a half the etiolated leaves of the sugar-cane exposed to the action of the ultra-violet rays were found to take a deep green colouration, whereas those exposed only to sunlight still preserved their yellow appearance.

In another experiment three rows of sugar-cane were planted: the first row was shaded with coloured glass so that the ultra-violet rays of the sunlight were decreased by 50 per cent.; the second row was planted in open sunlight so as to obtain all the ultra-violet rays naturally existing in the rays of the sun; the third row was planted so as to be fully exposed not only to the sunlight but to ultra-violet rays from the mercury lamp for a certain time each day. All of these rows received the same amount of fertilizers. After several months the result was that, in the first row the sugar-canes gained $1\frac{1}{4}$ lb. each, on an average; the canes in the second row gained $2\frac{4}{5}$ lb. on an average; while those in the third row gained $3\frac{1}{3}$ lb. average. The writer of the article thinks that there is a possibility of a future use of these rays in sugar-cane cultivation in Hawaii, where the experiments have been made, for, as he points out, the row of canes in the above experiment, exposed not only to the sunlight but to the ultra-violet rays of the sun, had considerably more sugar than the canes exposed to sunlight alone.

In another experiment, unripe pine-apples exposed to weak ultra-violet rays were found to ripen earlier than those under sunlight. Two rows of pine-apples were planted in an open field, the first row of which was exposed to sunlight only, while the second row, in addition to sunlight, was exposed to the ultra-violet rays of the mecury vapour lamp for forty minutes every morning. The result showed that the pine-apples in the second row ripened earlier, and were sweeter, larger, and more juicy than those in the first row.

An experiment made on etiolated banana leaves showed that after three hours action of ultra-violet rays the leaves began to take on a marked green colouration, while five hours sufficed to make their colour a deep green. Banana leaves and stalks exposed to ultra-violet rays after having been cut and kept in water were found two weeks afterwards to be quite fresh, whereas some kept in diffused daylight were almost completely withered after six or seven days. The writer thinks that by the use of these rays bananas may be ripened and sent unspoilt to distant markets.

The problem is to find a process by which these rays may be obtained cheaply. They may be produced abundantly by specially constructed mercury arc lamps with quartz sides, but the cost at present of such an installation to stimulate the growth of crops is commercially prohibitive.

THE TWO SPECIES OF CABBAGE PALM.

As some confusion exists whether the names royal palm and cabbage palm are only local appellations of the same tree, or whether they are really two species, the following note will be useful in clearing up the question.

According to Dr. Beccari, the well-known Italian authority on palms, there are two if not three species of Oreodoxa to which the name cabbage palm or royal palm is given in the British West Indies. In a monograph on the palms indigenous to Cuba, published in the *Pomona College Journal of Economic Botany*, Vol. II, No. 2, Dr. Beccari gives descriptions of these three species.

In the first place, *Oreodoxa regia*, the royal palm, is the species commonly found growing in the Greater Antilles—Cuba, Jamaica, Santo Domingo, and Porto Rico—and also in St. Croix. In this species the stem is usually more or less fusiform, bulging out sometimes in more than one place, giving the impression that the palm has been influenced during its growth by periods of unequal nutrition. It is true, however, that some individuals have stems almost regularly cylindrical from base nearly to summit. The leaflets in this species are alternately inserted in contrary ways along the midrib, and stand in four different planes, at least in its lower and intermediate parts, but are more regularly set, almost on one plane, towards the end. The fruit in this species is almost globose, the breadth being only little less than the length. The stamens of the male flowers are about as long as the petals when they open, and they remain fairly upright, between these latter.

A second species (*O. charibaea*), which occurs in Porto Rico, differs so slightly from *O. regia* as to be considered by Dr. Beccari as only a geographical form of the latter, or in any case nothing more than a second degree species.

The common cabbage palm of the Lesser Antilles, and apparently of Trinidad also, which is stated to be peculiar to those islands, is *O. oleracea*. The stem of this species is quite cylindrical and never bulging, being always thickest at the base. The leaflets in this species are equidistant, and all on one plane, especially in the intermediate portion of the midrib. Its fruit also differs from that of *O. regia*, in being rather elongate than globose, and being somewhat curved and concave on the side of the stigmas. The male flowers, too, are quite different in appearance from those of *O. regia*, as the stamens spring beyond the corolla a long time before the anther cells open, and are much longer than the petals, above which they lie almost horizontally. On account of this circumstance, the inflorescence of *O. oleracea* has quite a different appearance from that of *O. regia*. The white floury matter which covers the inflorescence of both palms when still enveloped in the spathes, and which is dispersed when the spathes open, is much more abundant in *O. oleracea*.

On account of its beautifully cylindrical stems, *O. oleracea* would seem to be superior to *O. regia* as an ornamental plant, in spite of the latter's royal designation.

PLANT DISEASES.

INTERNAL DISEASE OF COTTON BOLLS IN THE WEST INDIES.

In the recently issued number of the *West Indian Bulletin* (Vol. XVII, No. 1), there appears a paper on the above subject by Mr. W. Nowell, D.I.C., Mycologist on the Staff of the Imperial Department of Agriculture.

In a previous paper in the *West Indian Bulletin* (Vol. XVI, No. 3), the writer has shown that in the West Indies the staining of developed cotton lint takes place in the green unopened boll, and with the exception of a varying proportion due to external boll disease, is principally caused by direct infection of the lint with specific fungi, of which four species have been found, or, more rarely, with bacteria. Such infection was shown to take place, without apparent exception, through bug punctures, mainly made, under prevailing circumstances, by the cotton stainers (*Dysdercus* spp.).

The present paper discusses (*a*) the part taken by other bugs, especially the green bug (*Nezara viridula*), in injuring and infecting bolls, (*b*) the nature and significance of direct bug injuries which are not infected, and further, (*c*) records the occurrence of the fungi of internal boll disease in the seeds of numerous plants other than cotton.

The observations and experiments recorded were made during a visit of seven weeks' duration, from October 17 to December 9, 1917, to the island of St. Vincent.

The methods of study adopted included (*a*) field observations of the relation between the prevalence of bugs and the amount of shedding, boll injury, and infection occurring; (*b*) close examination and record, lock by lock, of parcels of fresh green bolls obtained from selected typical districts; (*c*) a series of experiments in which bugs of various species, from known sources, were confined in cambric bags on uninjured bolls of known age; (*d*) examination for infection of fruits of the wild and cultivated host plants of bugs; (*e*) attempts by means of direct examination, dissections, and cultures to elucidate the carriage of infection by the bugs concerned.

The conditions relating to the occurrence of bugs in the field are separately discussed by the Entomologist in another paper of the same Bulletin. The commonest species, *Nezara viridula* and *Edessa meditabunda*, known collectively in St. Vincent as bush bugs, have a wide range of hosts, but are most commonly found associated with leguminous plants, the latter especially with *Cajanus indicus*, the pigeon pea. On the estates most infested with these bugs there were heavy losses from the shedding or drying up of small bolls, and from direct bug injury. There was also a variable but rather low percentage of infection with internal boll disease.

The following is a summary of the paper first mentioned, which is the outcome of careful experimental investigation.

The success of the control measures adopted against the cotton stainer in that island was found to have reduced the prevalence of the disease to negligible proportions over large areas.

Severe infestations with the green bug and the pea chink occurred in some localities, and the resulting damage to cotton bolls afforded the principal subject of study.

Close attention was given to the direct effect of bug punctures on the bolls, and it was found, in regard to the green bug especially, that the resulting injury to the developing seeds prevents or stops the development of the lint, causes the shedding or drying up of young bolls, and is in both ways the source of heavy losses. Punctures made by cotton stainers and the leaf-footed bug have similar effects.

The losses brought about by direct injury are for the most part complete, and are additional to those caused by the staining of developed lint due to internal boll disease. The amount of injury of the latter nature was found to be notably less in the case of green bug than of stainer infestation.

The direct injury resulting from infestation with the pea chink was small in amount, and consisted of stained spots on the surface of the lint, occurring immediately below some of the small proportion of punctures which appeared to penetrate the wall of the boll. No injury to the seeds was observed in connexion with this bug, and no case of infection with internal boll disease.

A series of experiments is recorded illustrating the effect of confining bugs from known food-plants on previously protected bolls of known age. Evidence was obtained that the punctures of the green bug readily bring about infection with the fungi of internal boll disease, but only when the bugs are transferred from infected plants. No infection was produced even in the latter case by the pea chink.

SISAL CULTIVATION IN EAST AFRICA.

The third of a series of articles appeared in *Tropical Life*, March 1918, consisting of notes by Mr. E. H. Heron, Director of Agriculture of the Mozambique Company. The author bases his opinions upon experience of sisal cultivation in Portuguese East Africa and on the Zambesi River during the last nine years. The total area under sisal in these districts is between 19,000 and 20,000 acres of different classes of soil on plantations which are practically at sea-level, the highest altitude not being more than 400 feet.

The life of the sisal plant in East Africa is put by Mr. Heron at six and a half years, and rarely seven. The plant reaches maturity in the third year, thus allowing leaves to be cut for nearly four years, before 'poling' and the consequent death of the plant take place.

It must be remembered that the sisal plant is propagated either by bulbils, which are produced on the branches of the flowering pole, or by suckers, which arise around the parent plant from the underground rhizome. Mr. Heron devotes much of his article to the consideration of which of these two methods of propagation is the more advantageous. In reckoning the period of growth of the sisal plant, Mr. Heron only takes into consideration plants grown on suitable soil, and where the cultivation is conducted in a proper way during the whole life-time of the plants. He remarks that any neglect in the cleaning and cultivation, even when the plants are in good soil and under excellent climatic conditions, causes them to pole irregularly, and before their proper time.

With the exception of a few experimental patches planted from suckers, the whole area under sisal in the district has now been planted from bulbils.

Mr. Heron in summing up the advantages and disadvantages of this method of propagation, states that the advantages of bulbils are as follows:—

(1) They can be selected from vigorous plants that have all poled at the proper time.

(2) They are all about the same age and size.

(3) They can be planted out in large numbers in the nurseries at the same time.

(4) The collection of bulbils is cheap, costing only a few pence per thousand.

(5) Bulbils, after being in the nursery for about a year, are all about the same size, and therefore regularity in growth and size of the plants when set out in the plantation can be assured.

(6) Properly selected bulbils, well cared for in the nursery, and afterwards regularly set out in the plantation will produce plants that reach maturity at the same time, give the same number of cuttings, and pole at the correct time. Thus it can be arranged that the different sections of the plantation, will be ready for cutting at different periods of the cutting season, in this way supplying the extracting machine with mature leaves during the whole season.

If through unforeseen circumstances enough land has not been prepared to receive the bulbils at the end of the first year of their growth in the nursery, their growth will not be retarded, provided they have been planted in the nursery at the proper distance of not less than 20 inches by 20 inches. They may, in fact, be allowed to remain safely in the nursery for two years before being planted out.

There are two disadvantages, however, pointed out by Mr. Heron, in the use of bulbils:—

(1) On starting a plantation on these lines the best newly cleared land must be used for the nursery. It is true, on the other hand, that after removing the bulbils the same land may be used as a part of the regular plantation.

(2) The bulbils must remain about one year in the nursery before being set out in the plantation.

With regard to the propagation of the sisal plant from suckers, the following advantages of the method are noticed:—

(1) No nursery is required, as suckers can be set out in the plantation immediately they are taken from the soil.

(2) Suckers after being removed from the ground can be kept under cover for from six weeks to two months without in any way having their vitality affected.

(3) Suckers are extremely hardy, and can stand several weeks of dry weather after being planted out.

The disadvantages of this method are stated to be: —

(1) The cost of the collecting of them is considerable, owing to the fact that suckers grow irregularly around the mother plants.

(2) The difference in the size and development of the suckers growing around the same parent plant is very great.

(3) If a plantation is kept thoroughly clean, no suckers will be allowed to grow, therefore, if suckers are required, the plantation must remain uncultivated to a certain extent.

In conclusion, Mr. Heron condemns the method of planting from suckers, because he says that suckers when allowed to develop underneath the plant at all stages of its life, and then used for planting out, are liable to pole at the same time as the parent plant, causing the loss of two or three cuttings perhaps. As an instance, he mentions that in Portuguese East Africa he observed the plants on a section of 250 acres all poling in the third year after planting, only having given one cutting of leaves. These plants were grown as an experiment from suckers, and all poled at the same time as the parent plants.

Owing to the different size and development of each individual sucker, the growth of the plantation will be irregular, which involves on a large plantation increase of cost, owing to the necessity of more labour to perform the cutting.

Mr. Heron lays stress on the point that sisal must be carefully cultivated, and planted on suitable soil. The idea that it can be successfully grown in any kind of soil, or that when once planted the crop will look after itself, is quite a fallacy.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market for the month of May 1918:—

In reviewing the business and condition of the London produce markets for the month of May it will be necessary to point out that the actual period under review covers five weeks instead of the usual four weeks—the first auction having fallen on the second of the month and the last on the 30th. The only effect of the additional week is to add to the bulk of the products dealt with in a given time, and at this period of the year, the anticipation of the summer holidays also has some effect, more especially in normal times. The following are some of the principal details.

GINGER.

This article has been advancing in price for some little time, and still shows an upward tendency. At auction on the 23rd of the month sales were effected at the following rates: common to good common Jamaica, 110*s.* to 112*s.* per cwt., and medium to good 115*s.* to 125*s.* Cochin washed fetched 95*s.* and common 92*s.* 6*d.*, Calicut 88*s.* to 90*s.*, and Sierra Leone 90*s.* At the last auction on the 30th the prices were still advancing, good common Jamaica ranging from 112*s.* 6*d.* to 115*s.*, and medium to good 120*s.* to 125*s.*, while washed Cochin was quoted at 95*s.* to 97*s.* 6*d.*, and Calicut and Japanese at 95*s.* and 90*s.*, respectively.

SARSAPARILLA.

This drug was in good supply at auction on the 9th of the month, being represented by 15 bales of grey Jamaica, 8 of which were sold at 4*s.* 9*d.* per lb. for fair, which was said to be an advance of 3*d.* per lb. on previous prices. The other offerings were, Lima Jamaica 38 bales, 4 only of which found buyers at 4*s.* 6*d.* per lb. for fair. Ten bales of native Jamaican were offered, and all sold at prices varying from 4*s.* 2*d.* to 4*s.* 6*d.* per lb. for dull red and yellow.

CITRIC ACID, ANNATTO SEED, KOLA, LIME JUICE, CASSIA FISTULA, PIMENTO, TAMARINDS.

Citric acid was firm at the beginning of the month at 3*s.* 3*d.* to 3*s.* 3½*d.* per lb. A week later it advanced to 3*s.* 4½*d.*, and at the end of the month to 3*s.* 5*d.* Annatto seed was in full supply at auction on the 9th of the month, as many as 160 packages being offered but none sold; from 8*d.* to 9*d.* per lb. was the price asked. Kola also was in abundant supply at the same auction, but out of the 272 packages brought forward, 3 only were disposed of, being fair dried Jamaica halves, which fetched 11*d.* per lb. There has been a good demand for lime juice throughout the month, raw West Indian fetching 2*s.* 9*d.* to 3*s.* 3*d.* per gallon, according to quality. Cassia Fistula pods were stated to be in limited supply during the month, 115*s.* per cwt. being the price asked. It was reported during the month that there were large stocks of pimento in store, and that any quantity could be had at 5*d.* per lb. In connexion with this, it was also stated that pimento oil was obtainable at 21*s.* 6*d.* per lb During the month it was further stated that West Indian tamarinds had quite disappeared from the market.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, May 16.

ARROWROOT—No quotations.
BALATA—Venezuelan Block, 3/5 to 3/7½; Sheet, 5/11 to 4/3.
BEESWAX—No quotations.
CACAO—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 2/9 to 3/6; concentrated, £32; Otto of lime (hand-pressed), 16/6.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—No quotations.
RUBBER—Para, fine hard, no quotations: fine soft, no quotations: Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., June 27.

CACAO—Venezuelan, $10·75 to $11·00: Trinidad $11·00 to $11·75.
COCO-NUT OIL—$1·36 per gallon.
COFFEE—Venezuelan, 10c. to 11c. per lb.
COPRA—$6·75 per 100 lb.
DHAL—$12·50.
ONIONS—$2·50 per 100 lb.
PEAS, SPLIT—$11·00 per bag.
POTATOES—English, $3·00 per 100 lb.
RICE—Yellow, $13·00 to $13·25; White, $9·00 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS. & Co, June 8.

CACAO—Caracas, 12½c.; Grenada, 12½c. to 13c.: Trinidad, 12½c. to 12¾c.: Jamaica, 10½c. to 11½c.
COCO-NUTS—Jamaica selects, $34·00 to $36·00: Trinidad $37·00 to $39·00; culls, $17·00 to $19·00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—15c. to 17c. per lb.
GOAT SKINS—Jamaica, 85c.: Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per lb.
GRAPE FRUIT—Jamaica, importation prohibited.
LIMES—[illegible]
MACE—40c. to 48c. per lb.
NUTMEGS—27c. to 28c.
ORANGES—Importation prohibited.
PIMENTO—7c. per lb.
SUGAR—Centrifugals, 96°, 6·005c; Muscovados, 89°, 5·005c. Molasses, 89°, 4·948c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., May 30

ARROWROOT—$12·00 per 100 lb.
CACAO—$12·50 to $13·00 per 100 lb.
COCO-NUTS—$36·00 husked nuts.
HAY—$2·90.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations: Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations: Patna, no quotations; Rangoon, no quotations.
SUGAR—Dark Crystals, $4·75.

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A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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Need for Research in Tropical Agriculture.

AT a meeting of the Royal Society of Arts, May 8, 1918, a most interesting paper on the relation of biological science to the rubber industry was read by Dr. J. B. Farmer, Professor of Botany, Imperial College of Science and Technology. Much of this paper is so apposite to the relations of scientific research to tropical agricultural industries in general that in the following columns we quote chiefly from it.

Agriculture is fundamentally a scientific industry. It depends upon the utilization of natural knowledge, which after all is natural science, though it may not in all cases be recognized by the schools. The knowledge may be largely empirical, it may be very imperfect, but it must be there in some degree to ensure any measure of success. In tropical agriculture this truth is even more evident than in that of temperate climates, where for many generations a wide experience of crops has been accumulated. A new industry, such as most crops cultivated in tropical regions, relatively speaking, represent, demands the study of new conditions for the accumulation of the necessary knowledge.

It is here that research comes in. For although the empirical method of trial and mistake can lead to the slow accumulation of knowledge, it takes a long time, and is expensive. It is the chief business of science to strive to detect for practical use the relationship of cause and effect. But in nature we hardly ever encounter a simple problem. Each resolves itself usually into a number of what seem more elementary ones, not, unfortunately, always easy to solve. The immediate problem has to be disentangled or analysed into its simpler components, each of which has to be unravelled more or less fully. In this process much is learnt which is perhaps not directly convertible into cash, but which may lead to such improvement of actual practice that later on a substantial financial benefit may be obtained.

It would be wrong to say that no research has been undertaken with regard to tropical agricultural industries. On the contrary, much useful work has been carried out by agricultural departments in various

tropical lands. The trouble has been, however, that the few scientific workers have had their hands too full of routine work to carry out the enquiries that are necessary to obtain anything even approaching to a complete knowledge of tropical plant physiology. Professor Farmer in the course of his paper remarked:

'It must I think be clear to anyone who has watched the progress of most of our great commercial enterprises, that one of the commonest causes of arrest or decline lies in a certain lack of imagination which seems to be one of our national defects. The bird in the hand is not always really worth two in the bush, but we are rather too apt to grudge expenditure which gives no immediate promise of a tangible return. Our attitude to so-called "applied science" affords an illustration of this. Thus, when we have grasped the fact that we require scientific assistance to enable us to cope with the natural difficulties of disease and so on, we get out our mycologists, entomologists, and what not, and then set them down mainly to do routine work—to deal with current difficulties only. No serious attempt is made to tackle the really big problems. We have, as I have already remarked, no adequate establishments to deal with the important matter of breeding. Provision in the tropics should be made for such work on a liberal scale, and there ought to be no question of a five or ten-years' scheme, but it will have to be secured on a permanent basis, if any real good is to come of it. A well-staffed and well founded establishment will certainly, in the long run, repay all the expenditure many times over, but results of immediate practical value are not likely to come in this or next year, nor ought they to be expected or demanded.

'This is perhaps not the occasion on which to raise or to discuss details of high policy, but, in general terms, it is safe to say that the matter ought to be taken in hand by the Governments specially concerned, and administered by a body on which the planting industry, and also the relevant branches of science are properly represented. Such a combination of official, practical, and scientific men ought to be able to ensure that the work would be carried out on well-considered lines. The three lines of interest, if I may use such a term, would view the matter from different angles, and although there might be differences of opinion as regards details, the general outcome of such co-operation should make for real efficiency. But, as I have already said, it should be essential that the enterprise should be definitely freed from the start from all demands for early practical results. And furthermore, when once the general lines have been laid down, and good men have been secured, those responsible for conducting the experiments must be given as free a hand as possible —and the less said about time-limits the better.

'I believe it would be of great advantage if a suitably constituted committee were formed to serve in this country in connexion with any such scheme. The functions of such a committee evidently should not be administrative, otherwise friction would almost certainly arise, and it might seriously impede the usefulness of an institute working in a distant country, and confronted with conditions that might be imperfectly understood by persons living at home and unfamiliar with local circumstances. But a home committee, charged with advisory functions only, would serve the useful purpose of bringing the tropical institutes into direct contact with the clearing-house of European knowledge, both economic and scientific. From the latter point of view at any rate, such a connexion would seem to be eminently desirable, inasmuch as the results of the rapid advances which are being made in scientific knowledge and outlook would thus be rendered easily and naturally available to those engaged on the more specialized work of the institute or institutes. And such an association or committee, by furthering the aims and objects of the several institutes that may be brought into being, could not fail to react beneficially on the planting industry as a whole. Its efforts should be the more acceptable, since matters affecting individual trade interests would lie entirely outside the terms of its reference.

'The germs from which such organized institutes as I have indicated might be developed, are already in existence in the various agricultural departments of Colonial Governments, while influential bodies of men interested in the plantations have shown that they take an enlightened view of the situation. If they so chose, they obviously could do much, both by influence and material support, to promote the establishment of real research institutes.

'Of course the scheme would cost money, but the expense would be very small in comparison with the magnitude of the interests at stake.'

The Professor points out, in conclusion, that science has been invaluable in the service of the tropical agricultural industries, both from the chemical, and also, and especially, from the biological side. If these industries are to continue to prosper, it has become essential that the investigations of disease and immunity, of the mode and significance of the vital processes within the plants, as well as of the breeding of better races of plants, shall not only be maintained at their

present level, but considerably increased. A distinction will have to be drawn between the necessary routine, such as scientific sanitation and inspection work on the plantations, and the research work largely to be carried on in the institutes suggested. Both are essential.

In older countries the function of higher scientific research is connected with educational institutions of the highest standing—universities old and new. It would seem probable that the best results in the tropics might be attained by a similar relationship. Professor Farmer's ideas are therefore indirectly a further justification of the plea that has often been urged by those interested in the development of the tropics as to the need of establishing in these regions one or more teaching universities, where biological research in the science of agriculture might receive especial attention, seeing that, for practical purposes, agriculture is at present the only industry of these undeveloped countries.

CO-OPERATIVE CREDIT SOCIETIES IN MAURITIUS.

The report on the working of co-operative credit societies in Mauritius, for the year ended June 30, 1917, has been forwarded to the Imperial Commissioner of Agriculture for the West Indies, by Dr. Tempany, Director of Agriculture in that colony, and from this report it appears that very satisfactory work has been performed by the societies during the year under review. The total number of the societies was twenty-three, comprising 2,823 members.

A close control is kept over the operation of the societies by the official inspector, for it is found that it is necessary to exercise very careful supervision of accounts, as the system of book-keeping in force is by no means simple. The general principles involved appear, however, to be fully grasped by the members of the various societies, and errors are readily recognizable. In addition to the work of supervision of accounts, the inspector freely gives advice on all points to the managing committees of the societies.

The principal loans made have been for purposes of cultivation, and in special cases loans have been issued also for such objects as weddings and funerals. Some cases of advances for the purchase of land have likewise been recorded.

The necessity for prompt repayment of loans has been emphasized, and the report records that although the total of loans is considerably larger than in any previous period, the outstanding debts show an appreciable decrease over the total recorded in the preceding year.

In some few instances it has been observed that members of the managing committees of societies are in arrears of the repayment of loans which they have received—a very bad example for the bulk of the members. The tendency is also witnessed in some cases to grant disproportionately large loans to members of managing committees. Too great a tendency in this direction is to be deprecated, for it should be a guiding principle of such societies that, as far as possible, equal facilities should be afforded to all members to take advantage of the financial assistance which their society is in a position to offer.

While there have been no additions to the number of societies operating, and the number of members is about the same as last year, the increase in share capital points to steadily increasing popularity and appreciation of the movement. The total share capital on June 30, 1917, was Rs. 116,307, an increase of over Rs 10,000 on the previous year.

An outstanding feature of the year's work lies in the increase in the deposits of non-members, carrying interest, which have been placed with the societies. The amount of outside capital which such societies are able to attract to themselves in this way is a trustworthy indication of their condition, and of the confidence which the public reposes in them.

The sum of money to the credit of the reserve funds is steadily increasing, the policy having been adopted that no dividends are to be declared by any society until the expiration of five years from its foundation, and all profits earned are credited to the reserve fund during this period. This provides an adequate guarantee against the effect of unforeseen losses which may occur in the future. It would appear, on the whole, that the condition of the societies indicates operations on sound and safe lines.

The association of the work of the supervision of the societies with the Agricultural Department appears to produce satisfactory results. The work of the Agricultural Department is brought into touch with the small planters, and a spirit of confidence in the department, so essential for successful progress in agricultural matters, is aroused among them.

DEPARTMENT NEWS.

On the return of Mr. H. A. Ballou, M.Sc., to resume his duties as Entomologist on the Staff of this Department, Dr. J. C. Hutson, B.A., Ph.D., has retired from his acting appointment, which he held during Mr. Ballou's absence from December 1916 until the middle of July 1918.

Dr. Hutson is shortly proceeding to England to offer his services for war work.

A post-card has been received by the Imperial Commissoner of Agriculture for the West Indies from Lieut. J. A. Robotham, of the Machine Gun Corps, to the effect that he is now a prisoner in the Officers' Prison Camp at Pforzheim in Baden, Germany. Mr. Robotham was formerly Agricultural and Science Master at the Grammar School, St. Kitts. His friends might note his address, should they care to communicate with him

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From *Nature*, June 6, 1918, we learn that Dr. C. A. Barber, Sc.D., now Sugar-cane Expert in the service of the Government of India, formerly Superintendent of Agriculture for the Leeward Islands, has been made a Companion of the Order of the Indian Empire.

Dr. Barber's researches are calculated to be of very great service in arriving at a true knowledge of the genetic constitution of sugar-canes; at the same time they are already of value, as advancing the development of the Indian sugar industry. Prior to his work on sugar-canes Dr. Barber did much valuable work of a botanical nature, amongst which his researches on the growth of the Sandal-wood tree was particularly noteworthy.

SUGAR INDUSTRY.

THE POSSIBILITY OF INCREASED PRODUCTION OF SUGAR IN INDIA

An interesting note by Dr. C. A. Barber, on the possibility of increasing the production of sugar in India, has been published by the Agricultural Department, Madras.

As is well known, India has been importing increasing quantities of sugar during recent years, the annual total being nearly 1,000,000 tons. Before the war this imported sugar chiefly came from Austria. More recently Mauritius largely supplied the Indian market, but at present the imported sugar comes almost exclusively from Java. The question Dr. Barber raises is whether India, taking advantage of the world's shortage of sugar and the increased price resulting therefrom, can herself produce enough sugar for her own consumption, and even in the future become an exporting country, as she once was.

In the first place it is not an easy matter to start a sugar factory, and several years must elapse before such an enterprise can be considered to be placed on a firm foundation. Sugar making on modern lines must be considered to a large extent as a new industrial enterprise in India. A vital question as to its success is the price of sugar after the war. Dr. Barber thinks that it will take many years before the price sinks to the pre-war level, if it ever does, for the following reasons: (1) because there is a constantly increasing consumption of sugar in all countries, which he regards as likely to be permanent; (2) because it seems probable that the British Government will in future take steps to prevent the free dumping of sugar on the markets of the Empire by the countries at present at war with us; (3) because the particular area where beet is grown in Europe has suffered immensely by the great and calculated destruction of sugar factories there during this war; and (4) that, with the exception of Cuba, it is not likely that there will be any immediate great extension of the area under sugar-cane in the tropics.

With regard to the question of sugar-cane cultivation in India, it is to be noticed that the two great sugar-cane tracts in that country differ fundamentally. The first region consists of Madras, Mysore, the lower parts of Bombay, the Central Provinces, Assam, and Burma. In the main this tract is within the tropics, and thick tropical canes can be grown there to maturity, as in Java or the West Indies. The second region is extra-tropical, including the alluvial plains of the Ganges and Indus, and extending into the north of the Central Provinces and Bombay. In this region sugar-cane cultivation is at present confined to thin, hardy, indigenous varieties, generally unsuited for the economic production of sugar. In fact, this region may be called properly the wheat region of India, and it is a curious fact that at least 90 per cent. of the acreage under cane in India is to be found in this apparently unsuitable tract. The canes grown in this region are unsuitable, as is stated above, for the production of crystal sugar.

A second difficulty also in the way of the extension of sugar making in India is that the people prefer the extremely impure form of sugar known as jaggery or gur, which is prepared from the poor canes so extensively cultivated. Gur making can be conducted by anyone who has the canes growing: accurate tests regarding ripeness are unnecessary; no capital is required; and the cultivation of the canes and the making of jaggery can be discontinued at any time without loss. On the other hand, sugar making on modern lines requires large capital and the combination of many growers, and it can only be instituted after considerable preparation, and cannot be discontinued without serious financial loss.

Another difficulty with regard to the extension of cane-sugar making in India is the competition with other crops. In fact, sugar-cane growing depends on the relative profitableness of the crops now being grown compared with sugar-cane.

Madras, for instance, can grow sugar-cane as well as any average place in the tropics. Irrigation however is required, and thus irrigated crops, chiefly rice, enter into competition with the cane. Rice is perhaps the easiest crop to grow in this Province, while sugar-cane is one of the most laborious. It is not therefore likely that sugar-cane will replace rice to any large extent.

With regard to Mysore, which is not a rice country, Dr. Barber thinks it not impossible that with the extension of irrigation, sugar factories might be profitably started there.

In Bombay, where excellent cane crops of rich sucrose content are raised, it might not be difficult to extend largely the cultivation of sugar-cane, if the capital is available.

There is a reasonable hope that a great deal more sugar-cane than the present extremely small amount will be grown in the near future in the southern part of the Central Provinces, which is well adapted to the growth of thick tropical varieties of cane, but Dr. Barber does not consider that any large extension of improved varieties of sugar-cane can be looked for in Bengal.

There are large unoccupied areas of land in lower Assam on both sides of the Brahmaputra, which would seem to be well suited for the growing of sugar-cane. An experiment on a large scale has been made in this direction by the Government, and it is evident that, with certain precautions, excellent canes can be grown over large areas, and the prospect is distinctly encouraging.

In Bihar there are a number of sugar-cane factories, in the main working successfully. The chief need in that Province seems to be the introduction of superior varieties of cane, and the improvement of the local methods of agriculture.

With regard to the United Provinces and the Punjab, there does not seem to be much prospect of instituting sugar factories under the present conditions. The canes grown in these regions are exceedingly thin and fibrous, the yield per acre is small, and the percentage of the juice is often low.

There are large areas in Upper, Middle, and Lower Burma, where first class canes can be quite easily grown. There is any amount of uncultivated land available for the growth of sugar-cane, so much so that there is no part of India which can compare with Burma as a possible place for the installation of cane-sugar factories. The region however is but thinly populated, and labour would have to be introduced. At present everything connected with the sugar-cane industry in Burma is on an extremely primitive footing, but cane cultivation is being considerably extended.

SUGAR FACTORY RESULTS IN MAURITIUS.

The sugar factories of Mauritius, like those of Hawaii, have adopted a system of mutual control, whereby the various factories can compare the results obtained on the year's working. The sheet of such results on the working of twenty-six factories for the crop of 1916, published by the Société des Chemistes de Maurice, has recently been received at this Office. It contains a volume of statistics, some items

of which may be of interest to West Indian sugar manufacturers for the sake of comparison.

The sucrose contained in the canes operated on by the Mauritius factories, calculated on the weight of canes for the whole crop, ranged from 12·35 to 14·03 per cent., while the fibre content varied from 10·49 to 15·30. per cent. The sucrose left in the megass was from 3·31 to 5·08 per cent. The actual yield of sugar varied from 73·12 to 83.6 per cent. of the sugar content of the canes, and from 80·8 to 90·6 per cent. of the sugar content in the juice, these being the maxima and the minima of the averages of the several factories.

Comparing these figures with the results of last year's working of Gunthorpe's Factory, Antigua, and the Basseterre Factory, St. Kitts, given in the *Agricultural News*, November 17, 1917, it appears that the sucrose in the cane is much the same, whereas the fibre content is lower on an average in Mauritius than in those two islands.

The percentage of sugar left in the megass was much less in Antigua and St. Kitts than the average recorded in Mauritius, and the percentage of sugar recovered both from cane and from juice is much better in the West Indian islands than in the great sugar island of the Indian Ocean.

THE BRITISH GUIANA GOVERNMENT LIME FACTORY.

The report on the Government Lime Factory, worked in conjunction with the Government Industrial School at Onderneeming, British Guiana, for the period January 1, 1917 to March 31, 1918, shows that, on the whole, the factory has had a successful year, for although the prices obtained both for concentrated juice and distilled oil are lower than those of 1916, the working expenses have been reduced, and more limes have been dealt with.

A total of 3,504 bags of limes has been purchased at the factory, about half of which were obtained from Onderneeming farm, and the other half from farmers and villagers. The juice extracted was 27,652 gallons, and another 447 gallons of raw juice was purchased. These 28,098 gallons of juice yielded 54 hogsheads of concentrate, equal to 2,975 gallons, testing, on an average, 116 oz. of citric acid to the gallon. The oil obtained by distillation from the total quantity of juice was 1,100 lb., equal to slightly under 4 lb. per 100 gallons, as compared with 3½ lb. during the previous season. It was observed that juice distilled when entirely fresh yielded a greater return in oil than that stored for several weeks. The yield from fresh juice on several occasions exceeded 4½ lb. per 100 gallons, while that from stale juice sometimes fell below 2 lb. per 100 gallons.

In spite of the fact that the price of concentrated juice had fallen from £30 per pipe in 1916 to £28 in the present season, and the price of distilled oil had also fallen from 9*s*. per lb. to 6*s* 3*d*., the net profit on the factory's working was $875·75, approximately 16 per cent. on the capital outlay. The value of the factory is by no means represented by this sum only. It is also of value on account of utilizing the boys' labour on the Government Industrial School, the purchase of limes grown on the farm, and of firewood from the same source. The factory also provides a ready market for limes grown by farmers and villagers in the neighbourhood.

From the number of lime seedlings sold from the institution during the past three years it would appear that a considerable development of the lime industry is taking place. In 1915 there were 3,170 lime seedlings sold; in 1916 the total rose to 9,800; while in 1917 the large number of 17,350 was reached.

The usefulness of the factory has also been extended in other directions. A coffee pulper and coffee huller have been moved into the factory, and connected to the driving shaft of the mill. A grain mill has also been erected in the factory, and is doing useful work. A rice huller and polisher has also been installed, and had been working for five weeks, during which time it had milled rice for ninety-seven persons; it is much appreciated by the small rice growers in the neighbouring districts, and promises to be a remunerative investment.

NATIVE FOOD CROPS CAMPAIGN IN GRENADA IN 1918.

A copy of the report of the Agricultural Instructor, Mr. W. M. Malins-Smith, on the native food crops campaign in Grenada for the current year, has been forwarded for the information of the Imperial Commissioner of Agriculture. From this the following particulars are abstracted.

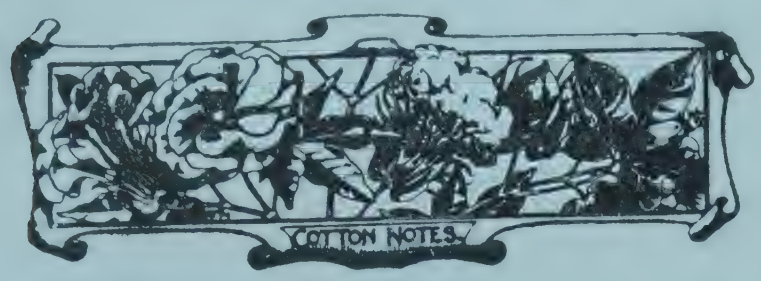
The distribution of plants and seeds to fifteen distributing centres, and the clerical work of the campaign were carried out by the Staff of the Agricultural Department. The Government, the Board of Agriculture, and the Agricultural and Commercial Society approved of an expenditure of £356 on the carrying out of the campaign, Mr. Malins-Smith being chosen as the Executive Officer. Committees were appointed in each parish for arranging and carrying out operations. Work performed to the end of March included the issuing of circulars and letters inviting the co-operation of the District Boards, the Commissioner of Carriacou, planters, clergymen, and head teachers of schools; the importation from St. Vincent and the storage of 7 tons of yams and 11 bundles of manioc (cassava) sticks; arrangements for the supply of tannia, eddoes, and dasheen plants; the planting of peas, beans, and sweet potatoes at certain experiment plots, and so on. In the distribution of plants and seeds to peasant gardeners, a ticket system was adopted. Special addresses were delivered by the clergy in their churches on the purposes of the campaign, and notices given by them of the dates and places of distribution.

A series of seven short papers was published in the Grenada *West Indian*, and, with the approval of the Society, these were subsequently printed in pamphlet form for free distribution, 500 copies having been issued.

Plants purchased for distribution included: yams, 15,680 lb.; tannias, 3,440 lb.; eddoes, 5,600 lb.; Indian corn, 70 barrels in cob; dasheen, 5,000 plants; manioc (cassava), 11 bundles of sticks (about 500 lb.). The total quantity of plants and seeds distributed throughout Grenada and Carriacou was as follows: yams, 16,480; lb. eddoes and tannias, 9,840 lb.; Indian corn (shelled), 5,407 lb.; pigeon peas, 344 lb.; dasheen, 5,000 plants; manioc, 1⅔ tons of sticks; sweet potato cuttings, 4 tons. Of the above 5,707 lb. of yams, 1,565 lb. of eddoes, and 900 lb. of corn were sold to planters; the remainder was distributed to 2,083 peasant gardeners.

Attached to the report are copies of the plan of campaign, of two leaflets on food production, and of a pamphlet on seasonal notes.

The efforts made in this campaign would appear to have been fully justified by the results already attained, which have been largely contributed to by the very commendable degree of thoroughness with which the executive duties of the Agricultural Instructor seem to have been discharged.



COTTON.

COTTON EXPORTS FROM THE WEST INDIES.

The following figures show the quantity and estimated value of Sea Island cotton exported from the West Indies for the quarter ended June 30, 1918:—

Colony.	Quantity in lb.	Estimated value, £.
Grenada	nil	nil
St. Vincent	174,965	29,161
Barbados	40,705	6,106
Montserrat	33,244*	4,543
Antigua	nil	nil
St. Kitts	,,	,,
Nevis	,,	,,
Anguilla	,,	,,
Virgin Islands	5,449	639
Trinidad	nil	nil
Total	254,363 lb.	£40,449

Besides the above, there were also exported of Marie Galante seed-cotton from Grenada, 221,424 lb., and from St. Vincent, 21,376 lb., of the estimated values of £21,885, and £1,781, respectively.

*The cotton shipped from Montserrat comprised 10,887 lb. of stains, valued at 1*s.* 6*d.* per lb,. and 22,357 of lint, valued at 3*s.* 4*d.* per lb.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended June 29, 1918, is as follows:—

ISLANDS. Since our last report of June 1 we have had a continuance of a very quiet market with limited demand, consequently the sales have been small. Notwithstanding this, the Factors hold the unsold stock very firmly at last quotations, consisting of about 350 bales classing Fine to Fully Fine, 150 bales more or less stained.

Shipments have been interfered with and delayed by the appearance of German submarines along the coast.

We quote viz:—

Fine to Fully Fine 72c. to 73c. = 74c. to 75c., c.i.f.
Fine to Fully Fine, stained, 50c. to 60c. = 52c. to 62c., c.i.f.

GEORGIAS AND FLORIDAS. We have to report a very dull market during the month, with only some occasional demand for limited quantity, and delayed shipments.

Although the Factors are showing more disposition to sell at quotations, they remain unwilling to make concessions to do so.

The Government is gradually forwarding their cotton purchased last winter to such mills as have been allotted contracts for goods.

The unsold stock is held at the following quotations, viz :—

Extra Choice to Fancy 73c. = 75c., c.i.f.
Average Extra Choice $72\frac{1}{4}$c. = $74\frac{1}{4}$c., ,,

The exports from Savannah since June 1 have been, to Liverpool 299 bales, to the Northern Mills, 238 bales, and from Jacksonville to the Northern Mills, 2,618 bales.

ACREAGE. The advices from Carolina and Florida are that about the same acreage has been planted, but in Georgia there has been a decided decrease, especially in some sections, where the boll weevil did much damage this past season. There is a general apprehension of much damage from the weevil this year again, as they have appeared more generally than last year, consequently crop estimates have a wide range of 60,000 bales to 90,000 bales.

THE HURRICANE SEASON.

With the advent of the hurricane season, a few notes in regard to the nature of storms and the signs which herald their approach at this period of the year are here reproduced from the *Agricultural News*, Vol. VIII, No. 108.

It is urged that instruction in connexion with this subject should be given in all secondary schools in the Windward and Leeward Islands, and possibly in the primary schools as well. One or two lessons given in each year immediately before the hurricane season should prove of real service.

A hurricane is a storm in which there is a great rush of air towards and around the centre, the whole mass moving slowly along. These storms originate near the equator, and generally travel in a westerly or north-westerly direction in the lower latitudes; recurve at about the latitude of the Bahamas, and take a north-easterly direction across the Atlantic. During the so-called hurricane season, storms originate at from 10 to 11 degrees north of the equator in mid-ocean.

It will be seen from what has been said, that Trinidad and Grenada, and even some of the islands of the Grenadines, are not at all likely to encounter one of these storms. St. Vincent and Barbados, however, and all the islands to the north lie in the storm track. The origin of these storms may be explained in the following manner.

If a mass of air, practically at rest, becomes very highly heated, a strong upward current is induced, and this creates a rush of air from all directions towards the point at which this upward current leaves the earth's surface. It was discovered by Ferrel, on purely mathematical grounds, that on account of the rotation of the earth on its axis, all moving bodies to the north of the equator swerve slightly to the right. This, it will be seen, would cause the rotating movement of the cyclonic storm. The rotation is thus from right to left, or in a direction opposite to the movements of the hands of the watch. South of the equator moving bodies swerve to the left, and the rotation of the hurricane is from left to right.

In a paper by Mr. Maxwell Hall, Government Meteorologist in Jamaica, on West Indian hurricanes as observed in Jamaica, published in the *Monthly Weather Review* of the Weather Bureau of the United States Department of Agriculture, December 1917, it is stated that cyclones require vapour which they turn into rain, thereby developing

the heat necessary for their prolonged existence; and it seems probable that the supply is insufficient until the month of August, when the region of equatorial heavy rains between South America and Africa reaches as far north as latitude 16°. It may be stated, however, that this theory of the mechanism of hurricanes is still under discussion by meteorologists.

In considering hurricanes it is necessary to distinguish clearly between the two distinct movements of the storm, which are known as rotation and translation. The rotation of the storm is the movement of the currents of air around the centre, and the translation is the forward progression of the whole storm along the storm track.

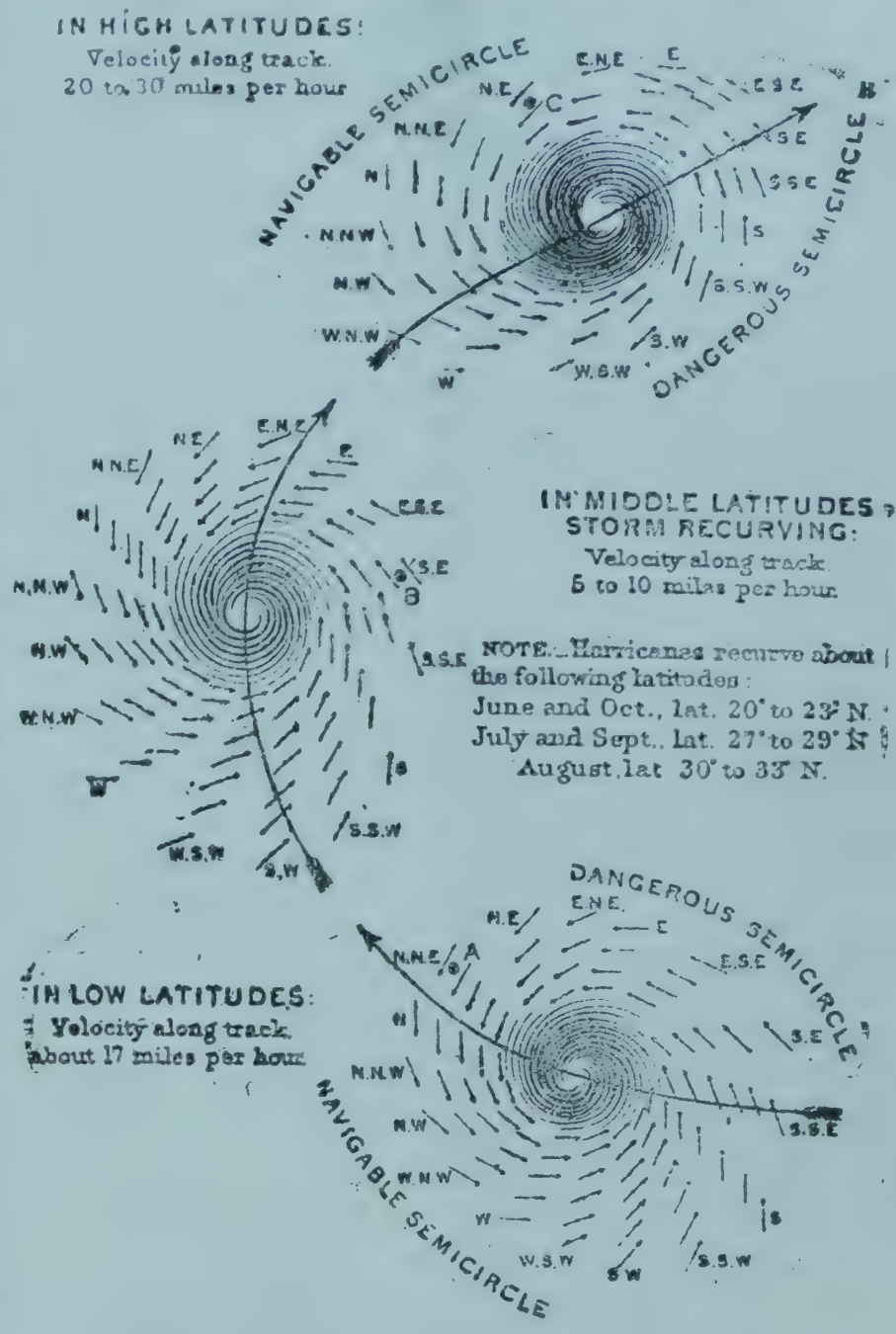
The rate at which the storm travels along the storm track (the translation) is not very great, ranging from about 10 to 17 miles an hour in these lower latitudes, but the velocity of the wind (in rotation) often becomes very great. It is not known what the limit of this velocity may be, but it has been recorded up to 120 miles an hour, with an air pressure of over 70 lb. per square inch. At the centre of the storm there is an upward rush of air, which produces the effect of a calm in the midst of the storm.

Reference to the accompanying diagram will help to make clear what has already been said about the rotating movement of the wind and the forward progression of the storm, the larger arrows indicating the latter. The small letters accompanying the small arrows indicate the direction from which the wind is blowing with reference to the storm centre.

The following premonitory indications are largely taken from the United States Pilot Chart. Before a hurricane the barometer is somewhat higher than usual, with cool, very clear, pleasant weather; there is a long low swell on the sea from the direction of the distant storm; the sky is covered with a quantity of light feathery cirrus clouds (mare's tails) radiating from a point on the horizon, where a whitish arc indicates the bearing of the centre. If the cirrus plumes are faint and opalescent in tint, fading gradually behind a slowly thickening haze or veil, the approaching storm is an old one of large area. If of snowy whiteness, projected against a clear blue sky, it is a young cyclone of small area, but great intensity. Great activity of movement of the upper clouds while the storm is still distant indicates that the hurricane is of great violence.

As the storm approaches, the following unmistakable signs display themselves: the barometer falls rapidly; halos are seen around the sun and moon; the ocean swell increases; the weather becomes hot, moist, and oppressive, with light variable winds; deep-red and violet tints appear at dawn and sunset, tints which assume a coppery glare or ominous aspect; a heavy mountainous cloud-bank on the distant horizon indicates the position of the approaching storm; the barometer falls more rapidly; and finally, if the observations are made on or near the storm track in the West Indies, the wind begins to blow in a direction between the north-east and north-west, soon rising to hurricane force, increasing till the central calm passes, then breaking out with violence from the south-west to south-east.

In the diagram, the northern portion of the storm is marked the dangerous semi-circle, because in this semi-circle the wind all the time is from an easterly direction, and all such winds blow to the front of the storm. The southern half of the storm is considered the navigable semi-circle, because the wind in this portion of the storm is always from a westerly-quarter, and blows toward the rear of the storm. It may be added that, owing to the usual track of these storms in these latitudes being about south-east to north-west, it follows that as soon as the word south can be used in describing the direction of the wind, the centre of the storm may be known to have passed, and the worst may be considered to be over.


IN HIGH LATITUDES:
Velocity along track.
20 to 30 miles per hour
NAVIGABLE SEMICIRCLE
DANGEROUS SEMICIRCLE
IN MIDDLE LATITUDES:
STORM RECURVING:
Velocity along track.
5 to 10 miles per hour
NOTE.—Hurricanes recurve about the following latitudes:
June and Oct., lat. 20° to 23° N.
July and Sept., lat. 27° to 29° N.
August, lat 30° to 33° N.
IN LOW LATITUDES:
Velocity along track.
about 17 miles per hour
DANGEROUS SEMICIRCLE
NAVIGABLE SEMICIRCLE

It is useful for an observer on land to have a clear understanding of the manner of ascertaining the progress of the storm along its track from observations on the direction in which the wind blows, and the changes which the direction undergoes.

It is clear from what has been said, that if the observer faces the direction from which the wind is blowing, the centre of the storm lies on his right hand. If he is directly on the storm track, the wind will remain constant in direction, with increasing violence and a rapidly falling barometer until the centre arrives; then there will be a short period of calm, after which the wind will suddenly begin to blow from the direction opposite to that previously experienced, and the violence will slowly abate as the centre passes away. It is essential to be on the lookout for this occurrence of wind of great violence after the passing of the central calm.

If the centre of the storm passes on the north side of the observer, the wind will steadily shift from north to north-west to west, and die away somewhere in the neighbourhood of south-west.

If, on the other hand, the centre passes on the south, the wind will steadily shift from north-north-east to east and die away some where in the south-east.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* / Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

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Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

**Seconded for Military Service.*
†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The need for research in tropical agriculture, and the benefits to be derived from such research, is the subject of the editorial.

Under Insect Notes, on page 250, will be found an interesting account of the feeding habits of some of the parasites which help to control the destructive grubs of hardback beetles.

Among the notes on page 254, under Plant Diseases, one on the powdery mildew of roses will be found useful by horticulturists.

An article on the signs of approaching hurricanes, on page 246, deserves attention at this season.

The Sugar Crop of British Guiana, 1916-17.

In the *Journal of the Board of Agriculture of British Guiana*, April 1918, an article contributed by Officers of the Department of Science and Agriculture of that colony, shows that the total area under canes for the crop of 1916-17 was 78,346 acres, an increase of 2,602 acres on the area for the crop of the preceding year. Of this acreage, 37,174 acres, nearly one-half of the total area, was planted with D. 625, the Bourbon cane being still planted on 9,109 acres.

In spite of its popularity, D. 625 has not given such a large yield as several of the varieties under cultivation, as is shown by returns supplied by managers of sugar plantations. According to the table attached to the report, the varieties yielding the greatest amount of sugar per acre are D. 216 and D. 433, which each gave 3 tons of sugar per acre, while D. 625 yielded 2·41 tons, and Java 247, 2·81 tons. The yield of the Bourbon was 2·10, while that of Java 1 was only ·87. The sugar yield per acre of seventy-two varieties is given in the table.

The export of sugar for the year 1916 was 101,649 tons, the total production being 114,292 tons. The total export of rum was 4,386,854 proof gallons. No molasses was exported during the year, but the export of molascuit was 997 tons.

Pusa Wheats.

The benefit which science is rendering to agriculture is strikingly brought out in the work at Pusa in India on wheat. The annual report on the progress of Agriculture in India shows that through the medium of Pusa No. 12, the cultivators of certain districts of the Punjab and the United Provinces have increased their output by 25 per cent., while the use of Punjab 11 is expected to yield an additional income of at least 2 lakhs of rupees in the year to the cultivators of 97,000 acres on which it was sown. In the Central Provinces again it is stated, in a note in the *Journal of the Royal Society of Arts*, June 21, 1918, that the 200,000 acres under various types of Pusa seed are bringing in an additional income of from 10 to 20 lakhs of rupees annually.

Mr. and Mrs. Howard, whose experiments in cross-breeding wheat at Pusa are known throughout the world, believe that the present varieties may be even surpassed by others, which they hope soon to be in a position to give to the cultivator. The area under wheat in the year under report amounted to nearly 33,000,000 acres; the possibilities therefore of increased food production in this direction are readily apparent.

The Wholesomeness of Water Containing Zinc.

It is often said that water stored in galvanized iron tanks, or passing through galvanized pipes becomes unfit for drinking purposes, because of the zinc taken up by the water under such conditions. It appears, however, that water holding a considerable quantity of zinc in solution may be considered perfectly wholesome, and

that the zinc has also a germicidal effect. An article in the *Lancet*, June 30, 1917, contributed by Dr. H. H. Scott, Government Bacteriologist in Jamaica, and Dr. W. W. Jameson, writing in collaboration, makes this quite clear. It is an account of very careful investigation and experiments on the supply of drinking water of a small depôt in the Aldershot command of some 200 men, which was found to contain from 2·5 to 4·72 parts of metallic zinc per 100,000, that is from 1·75 to 3·33 grains of zinc per gallon. The following are the conclusions arrived at.

During a period of two years this was the sole source of supply of drinking water, and no disturbance of health resulted.

In one household the disappearance of a persistent condition of ill health, attributed locally to a contaminated water-supply, coincided with the laying on of a water containing considerable quantities of zinc.

The number of organisms of the coli type developing at blood-heat from the well-water used as a control was materially greater than was found in the water after it had taken up from 3 to 4 parts of metallic zinc per 100,000, and remained in storage for two days at most.

To ascertain whether this effect on bacterial growth might be due to the zinc content of the water, various experiments were undertaken, from which it appeared: (1) that from 3 to 4 parts of zinc sulphate were sufficient after twenty-four hours contact to inhibit, if not to destroy, organisms in numbers considerably exceeding those likely to be found in any drinking supply; and (2) that even as small an amount of zinc sulphate per 100,000 as 1·5 renders such water practically sterile in forty-eight hours.

The use of water containing zinc naturally in solution as a carbonate, shows analogous results, but the reduction of organisms after the first twenty-four hours is not so great as by the use of the sulphate, though complete sterilization does appear to take place between forty-eight and seventy-two hours.

New Products from South Africa.

The results of investigations by the Imperial Institute of a large number of South African products were considered by the Committee for South Africa and Rhodesia at a recent meeting under the Chairmanship of the High Commissioner for the Union, the Right Hon. W. P. Schreiner.

A small consignment of liquid ostrich eggs was recently sent from South Africa for examination at the Imperial Institute, with a view to ascertaining its value as a substitute for liquid hens' eggs in confectionery. The material proved to be similar in composition to the commercial liquid hens' and ducks' eggs. The opinions of confectioners were favourable, and another consignment of the eggs is being obtained from the Union for further trials. There would appear to be a good opening for this material in the United Kingdom, if it can be exported in quantity.

Owing to the great scarcity of vegetable waxes of all kinds in the United Kingdom at present, it seems likely that there would be a good market for increased supplies of the sugar-cane wax which is being extracted from sugar-cane waste on certain estates in Natal. The shortage of tin-plate has led to the manufacture on a large scale in the United Kingdom of card-board containers for jam, syrup, and other foodstuffs. These containers must be coated with a film of hard wax to render them impermeable to the semi-fluid contents, and sugar-cane wax appears to be quite suitable for this purpose.

The Chicle Gum Industry.

Chicle gum is the latex of a variety of the sapodilla (*Achras Sapota*) which grows wild in large numbers in that part of Guatemala bordering on British Honduras. The chicle resources of that country are declared to be practically inexhaustible, although no one is permitted to gather the gum without a government concession. A large tree will yield as much as 100 lb. of the crude gum, and smaller and younger trees less in proportion. The gum is boiled in large iron pots, from which it is poured into wooden boxes with a capacity of 80 lb. each. The gum hardens in these boxes, and it is carried in this form to the shipping seaport, where it is removed from the boxes and packed in sacks for export.

The bulk of the product is shipped from Belize, British Honduras, to the United States, where it meets with a ready market for the manufacture of chewing gum.

The Mixing and Preservation of Manures.

As is well known, difficulties sometimes arise from want of information as to the descriptions of manure which may or may not be brought into association with each other. In an article appearing in the *South African Sugar Journal*, April 1918, an endeavour is made to clarify some of the doubtful points, and thus to reduce fertilizing to practice.

First, emphasis is placed on the necessity, when purchasing a manure, for insistence on a guarantee of its composition as determined by analysis. Then it is suggested that artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Lime, it is advised, should never be added to a manure containing sulphate of ammonia, or blood and bone manures, as in such cases loss of nitrogen results; and when lime has been applied to the land, do not use manures until three weeks afterwards.

When mixing various fertilzers together, such mixtures must be avoided as would lead to decomposition, as, for instance, ammonia sulphate mixed with lime or with Thomas phosphate, or superphosphate with nitrate of soda; or which may cause caking, as mixing kainit with Thomas phosphate, or with superphosphate.

All manures should be in a dry, friable condition, and must be free from hard lumps, and for this reason must be kept in good dry bags, and in covered sheds.

INSECT NOTES.

FEEDING HABITS OF THE PARASITES OF HARDBACK GRUBS.

Frequent references have been made in previous issues of the *Agricultural News* and other publications of this Department to the occurrence of the grubs of various species of beetles which live in the soil and attack the roots of cultivated and other plants, and the reports and bulletins of other Departments of Agriculture and Experiment Stations often include accounts of these insects. Some of these insects have long been known as pests, while others have more recently attracted attention on account of their depredations.

In recent years, soil-inhabiting grubs have become a much more prominent feature in agricultural practices in many parts of the world, both in tropical and temperate countries, and, at the same time, the parasites which attack them have come to be regarded with greater interest. Any parasite which attacks a pest of agricultural crops is of importance and interest, because of the likelihood that it may be a factor in limiting the numbers of the pest to such a degree as to prevent its causing serious damage to the plants, and consequent loss in the amount of crop obtained.

Several species of beetles, which in the larval stage of development attack the roots of plants, occur in the West Indies. One of these, the brown hard back (*Phytalus smithi*), which is known as a minor pest of sugar-cane in Barbados, and is recorded as occurring in Trinidad and Brazil, has, since 1911, come into great prominence as a most serious pest of sugar-cane in Mauritius.

It is believed that this insect was introduced into Mauritius not long before its discovery there in 1911. Its remarkable increase in numbers in that colony was without doubt due to its having been removed from the association with its natural enemies, one of which is now known to be the Scoliid wasp (*Tiphia parallela*), which is an active and efficient parasite of the beetle larva.

As the result of careful observation, Mr. W. Nowell, then Assistant Superintendent, Barbados Department of Agriculture, discovered in 1911 the relationship of host and parasite which exists between the grubs of the brown hard back and the Tiphia wasp, and published an account, which is to be found in the *West Indian Bulletin* (Vol. XV, p. 149) of this and a related parasitic wasp (*Campsomeris dorsata*).

From this account it appears that the adult female Tiphia, having found a suitable grub of Phytalus, stings it, thus rendering it quiescent or paralyzed. An egg is then laid on and securely attached to the surface of the grub's body. In a few days the egg hatches, and the young parasite grub, blind and footless, attaches itself by means of its mouth parts at the point where the egg was attached, and proceeds to suck out the contents of the beetle grub's body, this being completed at the time when the parasite has attained its full growth. The period of pupation follows, and in due course the adult parasite wasp issues forth.

This seems to be the usual method of feeding, during the larval stage by the several parasites of this group of wasps on the grubs of beetles.

The adults of some of these insects are visitors to flowers, feeding on the nectar which they find there. *Campsomeris dorsata*, for example, is a very frequent visitor to flowers; on the other hand, *Tiphia parallela* is not recorded as visiting flowers at all, but is known to feed on the secretions of plant lice, and, in captivity, on sugary liquids and honey.

Soon after the parasitism of Tiphia on the larvae of Phytalus was established, the Government of Mauritius attempted through the co-operation of the Barbados Government to introduce the parasite into Mauritius, with the object of establishing it for the purpose of controlling the epidemic of Phytalus attack. A paper entitled 'The Importation of Tiphia Parallela into Mauritius', by Mr. D. d'Emmerez de Charmoy, Government Entomologist, Mauritius (*Bulletin Entomological Research*, August 1917), gives a good account of the trials that have been made.

Five consignments of parasites and parasitized grubs were sent from Barbados to Mauritius: three in 1913, one in 1914, and one in 1915. Of these only one was successful from the point of view of living Tiphias arriving in Mauritius in condition to live and breed.

At the end of the year 1915, two couples of this insect were liberated near the Botanic Gardens, and two other couples escaped from the insectary at the Botanic Gardens. In May 1916, parasitized beetle larvae were found in the same field where the Tiphias were liberated about six months before, and later many adult Tiphias have been observed in the same vicinity. In May 1917, Tiphias were to be found in thousands on the estates near the Botanic Gardens.

The success of this importation seems to have depended altogether on the ability of the freed Tiphia adults to find suitable food during the period of mating and egg-laying. From this emerges a very interesting point, one which may also have a bearing on the local distribution of these insects in the West Indies.

It has been stated in the course of this article that adult Tiphias in Barbados feed on the sweetish secretions of aphides. In Mauritius, aphides appear only at a certain time of the year, and then are rapidly destroyed by their natural enemies. From this it was feared that the first Tiphias to gain their freedom in Mauritius would not be able to live and propagate on account of lack of suitable food, but they appear to have made up for this deficiency 'by having recourse to the sweetish content of the vesicular hairs of *Cordia interrupta*. This plant is a native of British Guiana, which was introduced about fifteen years ago; it is now a regular pest and infests all uncultivated fields.'

From reference to Floras of the West Indies, it appears that *Cordia interrupta* is a variety of *Cordia cylindrostachya*, the common black sage of Barbados and other islands. It seems certain that it is the chance introduction and establishment of this plant that has made possible the successful importation of *Tiphia parallela* into Mauritius.

In a report by the same author (Mr. d'Emmerez de Charmoy) dated December 1917, on the Importation of Scoliid Wasps from Madagascar for the purpose of controlling the large soil-inhabiting, root-feeding grub, *Oryctes tarandus*, the following statements occur in numbers 4 and 5 of the summary of general conclusions in relation to *Scolia oryctophaga*:—

'4. In attempting the introduction of *Scolia oryctophaga* in Mauritius for the purpose of parasitizing *Oryctes tarandus*, due regard must be had to the feeding habits of the adult insect, and provision be made of an adequate supply of suitable nectar-bearing flowering plants in the localities in which it is desired they should increase.

'5. The most suitable plants for the purpose appear to be *Cordia interrupta* and *Urena tomentosa*, and it is desirable that these plants should be established on the borders and in the vicinity of cane fields in the districts in which introduction of the parasite is to be effected.'

The difference between the method of feeding of the larvae and of the adults of these parasitic insects is of interest, and while the actual feeding of the larva, causing the death of another insect which is an agricultural pest, is rightly considered a matter of greatest importance in estimating the value of the work of the parasite, it is shown that the very different habits of feeding on the part of the adults must be taken into account in any attempt to introduce these insects from one country into another, or to distribute them from one locality to another in the same country. The varied feeding habits of the adults of nearly related species make it necessary to study each species by itself in this respect.

The matter of parasite introduction is now recognized as involving much more than the mere carrying of the adults from one place to another, and liberating them in good condition to live and increase in numbers.

H.A.B.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

NEVIS. On account of the prevailing dry weather, operations at the Botanic Station during the month of June were practically at a standstill. The following represent plant distribution from the Station during the month: sweet potato cuttings, 25,000; white velvet beans, 18 lb., Mazzagua Guinea corn, 2 lb. Mr. W. I. Howell, the Agricultural Instructor, states in respect of staple crops, that the young canes throughout the island are suffering very much from want of rain; the supplies have grown very badly, and the fields are all irregular. The cotton crop also is making very slow progress on account of the dry weather. There being no opportunity for supplying, many of the fields are growing very irregularly; in some places planting has not yet been done. A fair acreage was planted in provision crops in May, but these are doing badly on account of the prevailing dry weather. The rainfall for the month was 2·02 inches; for the year to date, 18·95 inches.

The Report of the Agricultural Instructor for the quarter ending June 30, which has also been received at this Office, mentions that in the Experiment Station an acre plot was planted in the best varieties of sweet potatoes during the early part of the quarter, chiefly with the object of supplying cuttings to growers when the weather permitted planting to be done. This plot of potatoes, Mr. Howell states, has proved of greatest value to planters in the island, for in the month of May, when the rains came, there were practically no potato cuttings available elsewhere, and a very large number of cuttings was distributed from the Station.

There has been a great demand for muscovado sugar in the neighbouring islands, chiefly at Antigua, where good prices were obtained. Advantage was taken of this by planters in Nevis, and it is now feared that there will be a shortage of sugar during the latter part of the year, as practically the whole crop has been sold, and very little kept on hand for local consumption.

The total quantity of cotton purchased for the Admiralty now amounts to 1,324 bales, weighing 398,592 lb. This cotton was not all grown in Nevis; a fair quantity came from the Dutch islands, and from Montserrat.

VIRGIN ISLANDS. The Curator, Mr. W. C. Fishlock, writes to say that lack of labour interfered considerably with operations in the Experiment Station during the month of June. In consequence it has been impossible to plant any cotton or other crops in the experiment plots. What little labour was available had to be utilized in keeping cultivation already established in some semblance of order. Plant distribution included 376½ lb. of cotton seed, and 24 cobs of Indian corn. The outlook as far as the cotton crop is concerned is good: the weather has been favourable, and there has been considerable activity in planting, on an area probably larger than for some years past. Large areas have also been planted in ground provisions, and all cultivations are at present in good condition. No pests have been reported. Rain fell in measurable quantity on thirteen days of the month, the total precipitation registered at the Station being 4·83 inches. The average for the same month for the preceding seventeen years is 4·54 inches.

AGRICULTURE IN BARBADOS.

There is no comparison between the rainfall of this month with that registered last July. Last year some districts had as much as 10 inches for the month, and in most parishes the total was 12 inches. This year the record to date is about 3 inches in the south of the island, and slightly over 4 inches in the central and northern parishes. This total is somewhat below the average rainfall for July, but the distribution of it has been very satisfactory.

With the closing of the crops, no time is being lost with the tillage of various kinds which are taken in hand at this time of the year.

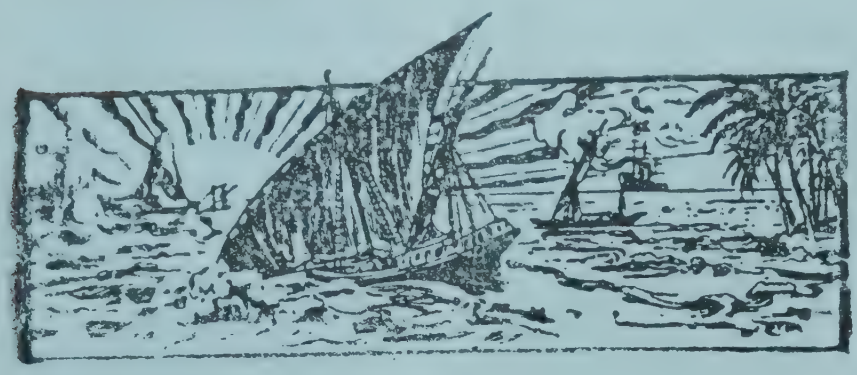
We observe that trash is being turned in in a very fair number of fields. This means that fertilizers will be applied at a later date to these fields, instead of farmyard manure. Already we can see carts proceeding to the various parishes with sheep manure evidently for application to fields which will not receive a share of home-made manure. It would be well if fields thus treated could also be green-manured. It should be remembered that green manuring is feasible, inexpensive, and has been reckoned among the most potent agents for enriching the soil. At this time when mineral manures are so scarce and so costly nothing that can add to the ferlility of the soil should be omitted.

Agriculturists will always find it to their advantage to improve the land without the aid of foreign manures. These are valuable as a stimulant. but the back-bone should be vegetable and animal manures.

Field pens are being forced everywhere, and it is surprising to see how quickly heaps of compost are built up, and the hurdles removed to other fields. Not only are estates carting the manure from the yard into the hurdle pens for forcing purposes, but they are buying manure from labourers or others so as to hasten each heap to its conclusion. Of course, the faster that cane trash and cane-tops can be trampled into the pens the better. The most successful planter is he who can provide the greatest quantity of well trampled manure for application by the time his fields are ready to receive the cane plant.

The provision crops have started well. We do not think the yam crop in general is as advanced as we have been accustomed to see it. The majority of fields seem to have been planted later than usual, owing, perhaps, to the necessity there was for planting potatoes first.

Potatoes are still scarce. As soon as it is known that a field is for sale, it is practically surrounded by carts, and at the end of the first day almost the whole field has been bought up. There are standing fields of corn in many districts, but very little has as yet been harvested. (The *Barbados Agricultural Reporter*, July 27, 1918.)



GLEANINGS.

The House of Assembly, Barbados, at a recent sitting, after considerable discussion, rejected a resolution introduced by the Attorney General on behalf of the Government, in which it was proposed to grant a bounty on increased production of cotton in the island, in order to stimulate its cultivation.

The St. Croix *Avis*, July 20, 1918, states that corn meal is being ground at the Bethlehem factory. It was fine in quality, and of a rich yellow colour. It was obtainable locally at $10·50 per sack of 175 lb. This industry, says the *Avis*, must be regarded as a boon to the consumers of this staple article of food.

The *West India Committee Circular*, May 30, 1918, draws attention to an address of the Governor of Mauritius, Sir H. Hesketh Bell, to the Board of Agriculture of that island, on the possibilities of lime cultivation. The Agricultural Department proposes to se'ect a suitable piece of land of not less than 15 to 20 acres on which to start a lime plantation.

In the report of the President of Stanford University, California, for 1916, on the Botanical Department, we notice that portions of the University estate have been set aside, and will be fenced, to form permanent plant reserves for the perservation of the native vegetation. These tracts will prove valuable for future study of native types by plant physiologists.

Arrangements are being made for the establishment of a factory in Yucatan for the manufacture of bags and sacks from the henequen fibre, which in the past has all been exported in its unmanufactured condition. The sugar growers of Cuba use 10,000,000 sacks annually, and the Yucatan factory proposes to supply this demand. (The Cuba *Review*, June 1918.)

A new company for the exploitation of vegetable oils, established last year at Wakamatusu in Japan, hopes to begin manufacturing in January. The consumption of raw material (soya beans) will, it is stated, be 100 tons per day, approximately 30,000 tons annually. The output of bean cake will be 24,000 tons; of bean oil, 4,200 tons. (*The Board of Trade Journal*, June 20, 1918.)

According to the *Proceedings of the Agricultural Society of Trinidad and Tobago*, June 1918, there are unduly large stocks of cacao on hand in the island. The quantity officially permitted to be shipped to the United Kingdom, namely 22,500 bags of 200 lb. each, has for the most part already gone forward, leaving about 6,000 bags only for permitted shipment in the coming six months.

The Trinidad *Guardian* in a recent issue reports that experiments are being conducted at the Usine St. Madeleine, Trinidad, with the view of manufacturing refined white sugar for local consumption and for export. The future of the refinery effort will probably depend chiefly upon the reception which the local public may give to locally refined sugar.

A new breed of cotton has been developed in St. Croix, which gives promise of large yields. Last year, on a field of 7 acres, this new cotton gave an extraordinarily large yield per acre. Samples have been sent to Liverpool, and the reports on it are excellent. Dr. Longfield Smith, Director of the Experimental Station in St. Croix, says that this year there will be a considerable acreage planted to the new variety. (The St. Croix *Avis*, June 29, 1918.)

According to a survey of the United States Food Administration's Sugar Division, the quantity of sugar used annually by the manufacturing industries of the United States amounts to nearly one million short tons, approximately 25 per cent. of the total sugar consumption of the States. Recent figures given out officially in the United Kingdom put the proportions there at over 30 per cent. of the total consumption. (The *International Sugar Journal*, June 1918.)

In advocating more extended use of bananas as an article of food, the *Journal of the Board of Agriculture of British Guiana* points out that the fact that bananas may be obtained in abundance throughout the year, that they may be used either cooked or raw, or dried or powdered, shows that in this fruit we have an addition to our dietary which should not be underestimated, as the banana will stand comparison with any food upon the market on the basis of caloric costs.

For the last quarter of 1916 the value of the corn meal imported into Jamaica amounted to £20,774, and for the same period of 1917 the value was £15,508. In 1916 the value of imported corn for the same period was £6,113; for the last three months of 1917 it was £33. These figures show almost conclusively that with only £33 worth of corn coming into the island for three months, it could grow enough to supply all its needs. (The *Journal of the Jamaica Agricultural Society*, May 1918.)

Marine fibre, derived from the sea plant *Posidonia australis*, is said to be obtainable in great quantity in the shallow water of Spencer Gulf, Australia. It is being commercially exploited, and fair qualities of paper have been made from the fibre, which is also employed in the manufacture of bedding, and its use by the textile trade is being advocated. The cost of production is estimated at about $81·57 per ton delivered at a European port. The market value of the fibre is about $110 per ton. (*Experiment Station Record*, Vol. XXXVIII, No. 6.)

British Guiana has benefited immensely by the present war. These colonies are in the enviable position of being very remote from unpleasant circumstances, such as air raids, wholesale compulsory rationing of our food, and other horrors of modern warfare. We could, however, have benefited to an infinitely greater extent had we in the earlier years of the war more fully grasped what lay in store for us. If in 1914 the farmers throughout these colonies had anticipated the present situation, it is safe to predict that our supplies of food grown within them would be now neither short nor high in price. (The *Journal of the Board of Agriculture of British Guiana*, April 1918.)

THE SUCCESSFUL CULTIVATION OF GUAYULE.

What is known as guayule rubber is the product of a shrub not more than 2 or 3 feet high, which grows abundantly in some of the desert regions of Mexico. This shrub is known botanically as *Parthenium argentatum*, of the same genus as the common West Indian weed known in many of these islands as 'white head', which is *P. Hysterophorus*. The guayule shrub is the only member of the Compositae which contains India rubber in sufficient quantity for commercial exploitation. Indeed the contents of rubber in *Parthenium argentatum* is so great that this plant is the richest in yield of all known rubber-bearing plants, the average content of pure rubber substance being from 8 to 10 per cent. on the dried plant material. In the later years of the nineteenth century companies were formed for the exploitation of this product in Mexico. The largest of these was an American concern; and the story of how this American company has attained remarkable success in guayule cultivation is a striking instance of what was pointed out in the editorial of the last issue of this Journal, namely the benefit to be derived by agriculturists from the researches of plant physiologists and other scientific men.

This story appears in an article by Mr. Henry C Pearson in the *India Rubber World*, July 1, 1918, from which the following paragraphs are chiefly compiled.

To those in charge of the American concern referred to above, it was perfectly apparent ten years ago that the time would come when the wild guayule fields would be exhausted, and the business be either entirely stopped or shut down until new plants matured. No one knew whether regrowth could be induced, or whether the shrub could be raised from seed or cuttings. In fact most people believed that the plant would never yield to profitable cultivation.

The head of the company set about solving the problem in the right way, and here is the interest of the story. The first thing done was the selection of a corps of chemists, botanists, plant physiologists, and experts in desert plants. For this purpose men were obtained from agricultural colleges, desert laboratories and experiment stations, and arrangements were made to send their notes and observations to seats of botanical learning, so as to obtain accurate conclusions on the subjects investigated. The following points in relation to the plant were examined most thoroughly: the geographical and altitudinal distribution, climate, air and soil temperature, rainfall, soil moisture and relative humidity, analysis of soils and of plants under all conditions. The seeds, leaves, flowers, stems, and roots were scrutinized under the effects of disease, drought, rain, and irrigation.

In time the work begun in Mexico was transferred to California and Arizona, where laboratories and experimental plants were established, and the work on a commercial scale actually commenced. But before this took place the plant may be said to have been practically remade by science.

In the first place, the wild plant of the desert yields very few good seeds. As plenty of vital seed is an essential for extended cultivation, the plant physiologists planted the guayule under all kinds of conditions, until positive knowledge was gained what treatment was necessary to obtain plentiful seeds. There was another difficulty in connexion with the seeds of the wild plant. Although the seeds appeared to be perfect, very few could be induced to germinate. It may be mentioned that of seeds of the guayule obtained by the Imperial Department of Agriculture for the West Indies from Mexico some time ago, and distributed for trial among some of the Botanic Stations in these islands, not one germinated. In the experiments now being described the same thing happened. Of a bushel of seed first planted most carefully not one grew. For a long time only failure resulted in this direction, although small lots of seed were sown under every imaginable condition, and the problem was only solved by what Mr. Pearson calls an accident.

Another difficulty in profitable cultivation of guayule was the question of its slow growth. Under desert conditions in its original habitat the plant takes some twenty years to arrive at maturity. It only grows a little at one season in each year. The plant physiologists however took advantage of this habit of a slight growth in the spring, and furnished the plant, so to speak, with simulated springs, so that before it could settle back for months to rest, the plant began growing again. By this method the shrub was induced to attain its full growth in four years.

The study of the varieties of the guayule led to most satisfactory results. The plant physiologist, to whom this investigation was entrusted, states that he had observed more than 900 different types of the plant. An analysis was undertaken in the first place to ascertain the difference in the amount of rubber in the different types. This was shown to vary from 1 per cent. to as high as 20 per cent., and sometimes even to 27 per cent. The poorer varieties were eliminated, and those that produced the largest percentage were selected as seed bearers.

Guayule rubber was not at first considered to be of the highest grade. When it first came upon the market its resin content was so high, and it was so soft, that it was accepted with reluctance. The plant physiologists, however, when they began to test the quality of the rubber in different plants, found out some more secrets. Some of the types gave simply a black resinous paste that did not contain enough rubber for extraction. Others contained rubber with about 20 per cent. of resin, the kind of rubber familiar to dealers in the guayule product. A few, however, yielded a firm, hard product equalling the best rubber. In this case also the types producing the best rubber were planted as seed bearers for cultivated guayule. As a final result, by hybridization of the types producing the largest quantity of rubber with the types producing the best quality, plants were obtained having the good points of each, so that at length the real cultivation of guayule was demonstrated to be feasible.

The growing of India rubber, particularly the tapping of the trees and gathering of the latex is entirely done by hand in the great plantations of the East. In the cultivation and collection of guayule, however, machinery takes the place of men. The preparation of the fields is done by disc harrows drawn by tractors. The planting is done by specially built machines which plough four furrows, set the plants at the proper intervals, cover them in, and pack the earth about the roots. One machine plants 18 acres a day. The cultivation is also done by machinery. For gathering, there are two systems: in one, the rows are cut down by a reaping machine; in the other, the plant is p'oughed out root and all. The extraction of the rubber is also, of course, wholly mechanical.

Guayule growing in a large plantation involves a laboratory for examining and testing the plant and the product, a green house for seed experiment and hybridization, out-door plants for seed bearing, seed beds protected by wind-breaks, machinery for planting and harvesting, an extraction plant, and plenty of capital. As an example of beneficial co-operation between science and practice, the successful cultivation of the guayule plant is a striking one.

PLANT DISEASES.

A MARKET DISEASE OF CITRUS FRUITS.

In *Phytopathology*, Vol. VIII, No. 2, O. T. Wilson, of the University of Cincinnati, gives an account of a hitherto undescribed disease common on Florida-grown limes on sale in the Cincinnati markets. The matter has local interest inasmuch as an affection identical in the peculiar characters described has been met with now and again, by the present writer, on West Indian oranges imported into Barbados.

The affected fruit is recognizable by the presence of surface areas more or less discoloured, which are smooth in comparison with the normal surface, the colour varying from a deepened yellow to copper colour, with the margin of the spot mostly brownish. Upon opening a diseased fruit an abnormal odour can be detected. A distinctive fungus is found in the fruits so affected. It has been cultivated by Wilson, and the disease reproduced in inoculated limes.

When the fruit is surface-sterilized and left for developments, no soft rot takes place, but it gradually dries up and becomes mummified, the exterior blackening, and the contents being converted into carbonaceous material mainly constituted of dense black mycelium. In this condition the fruit may be kept for months, if protected from scavenging insects, and, according to Wilson, the mycelium retains its vitality. No fructification has been observed by Wilson, nor did the present writer succeed in several attempts to induce spore formation.

W.N.

POWDERY MILDEW OF ROSES.

Several requests have reached this Office recently for information as to the control of rose mildew. At this time of the year, when new shoots are put out freely, and may develop under conditions of considerable atmospheric humidity, the trouble is especially common. The young shoots and leaves are externally invested with grayish-white mycelium and conidia, which give them a powdered appearance; the leaves are more or less discoloured and crumpled.

Certain types of rose, especially the ramblers, are very susceptible to the disease, and the best way of avoiding the trouble is to grow others more resistant, of which there are enough and to spare. It may, however, be effectively controlled, on plants which are otherwise in good condition, by the use of flowers of sulphur. This material may be diluted about one-third with powdered air-slaked lime if desired. According to recent writers in America, some advantage has been gained by using a mixture of 90 parts of sulphur and 10 parts of arsenate of lead. The powder should be dusted on in the early morning, while the foliage is damp, a day being chosen which seems likely to afford hot sunshine without showers. This treatment is much more effective than the use of Bordeaux mixture, and avoids any unsightly deposit on the leaves.

W.N.

SEED TREATMENT AND ANGULAR LEAF-SPOT.

In view of the importance to cotton growers of angular leaf-spot and the related boll-rot due to *Bacterium malvacearum*, a paper on the similar spot of cucumber, caused by *Bacterium lachrymans*, with reference to the effects of seed treatment, has considerable local interest. Information as to the means by which *B. malvacearum* is carried over from season to season is lacking, and pending the needed investigation some analogy with the cucumber disease may be assumed.

W. W. Gilbert and M. W. Gardner, in *Phytopathology*, Vol, VIII, No. 5, give particulars of large scale tests of the theory that overwintering may take place on the seed. Seed was surface-sterilized by various means, the most satisfactory of which proved to be immersion for five minutes in corrosive sublimate (mercuric chloride) 1:1,000, followed by fifteen minutes washing. Trials were made on whole fields, some in which diseased cucumber crops had been grown the previous year, others with clean soil. The use of treated seed in infested soil, and of untreated seed in clean soil led to the appearance of the disease in July, and its destructive prevalence by August 1. In fields planted with treated seed on clean soil, the disease made only a belated appearance at a few isolated points, from which it slowly spread, but never attained to destructive prevalence. As all the ground was cultivated by the same workmen, the authors suggest the possibility of such infections as did occur on the latter fields having started from infective material conveyed on implements or clothing.

The conclusions to be drawn from the experiment are these: that infestations may arise from infested soils or from infested seed; that surface sterilization of the seed removes the latter source of infection; and, in general, that crops grown from treated seed planted in clean soil should remain free of the disease, except so far as it is incidentally introduced from outside during their development.

The practice of treating cotton seed with corrosive sublimate appears to have largely fallen into disuetude in these islands. It is probable that the benefits which may in some cases be obtained are worth the amount of trouble which the treatment entails.

W.N.

STUDIES OF LEGUMINOUS PLANTS.

The results of preliminary studies by N. Gangulee on some aspects of nitrogen fixation in certain leguminous plants suitable for green manuring in Poona, recorded in the *Poona Agricultural College Magazine*, 8 (1917), receive reference in the *Experiment Station Record* for June 1918. From these results it appears that the experiments were planned to study the following points: At what stage of growth nodule development and, hence, nitrogen fixation begins; the quantity of nitrogen fixed in the whole plant at various stages of growth; the proportion of nitrogen fixed at various stages of growth normally occurring above and below the ground, the latter being only available with ordinary cultivation for an increase in the permanent fertility of the land; and the influence of available potash, phosphoric acid, and lime on nodule development, and their effect on the quantity of nitrogen fixed in the whole plant at various stages of growth.

As certain of the plants experimented with are at present grown in the West Indies for green-dressing purposes, a summary of the conclusions arrived at in connexion with these is given below.

Dolichos Lablab (bonavist bean) began nodule formation about fifteen days after germination, chiefly on the primary roots. Nodules formed on the smaller roots except at the extreme ends, but gradually disappeared as the plant approached maturity, with a few large nodules (about the size of a pea) remaining on the larger roots. The nitrogen in the plant gradually increased from 0·21 per cent. in the dried seedling to from 3·7 to 3·9 per cent. in the dried plant at the flowering stage. The portions above ground con-

tained considerably more nitrogen than the roots, at all stages of growth.

Cicer arietinum (the chick-pea of Europe) developed nodules chiefly on the primary roots, although from fifteen to twenty days after germination the large nodules shrank and numerous small ones formed on the smaller roots. Nitrogen increased from 0·23 per cent. in the dried plant just after germination to 0·55 per cent. at the end of the seedling stage. The above-ground portions of the seedlings are reported to have contained from five to six times as much nitrogen as the below-ground portions.

Crotalaria juncea produced an abundant supply of nodules throughout the root system of healthy plants, especially in the presence of an excess of phosphates. The nitrogen increased rapidly during growth, the maximum being reached at time of full flowering, and the most rapid increase occurring between the eleventh and twenty-fifth days of growth. Nitrogen accumulation appeared to be in direct proportion to an excess of phosphoric acid and lime, while excess potash gave distinctly inferior results, except in the very early seedling stages.

This plant is cultivated very commonly in gardens in the West Indies under the name of 'sweet pea'. It is largely grown in India as a source of the fibre known as sunn hemp.

Nodules first appeared on *Phaseolus mungo radiatus* (woolly pyrol) when the seedlings were about ten days old. With an excess of potash and lime small nodules formed largely on the primary roots, but extended throughout the root system as the plant approached the flowering stage. An excess of lime encouraged nitrogen fixation, and nodule development particularly, while similar results were obtained with an excess of phosphoric acid.

ELECTRIC POWER SUPPLY.

Early in 1917 the President of the Board of Trade appointed a Committee 'to consider and report what steps should be taken, whether by legislation or otherwise, to insure that there shall be an adequate and economical supply of Electric Power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development.' The Report of that Committee, dated April 29 last, has now been issued. An article dealing with this report appears in *The Board of Trade Journal*, May 30, 1918, from which the following extracts are taken: —

The supply of such power was now seen to be virtually as essential as labour and materials, in so far as it affected economical production.

The extent to which electricity might be further applied to cheaper and better mechanical production, to improved railway service, to electro-chemical and metallurgical processes, to agriculture, and to domestic labour-saving apparatus, was altogether incalculable.

It should be recognized that cheap electrical power would in the future be essential to the industrial progress of this country. The concentration of large generating units in larger and fewer power stations was urgently required in order to reduce the cost of industrial power to a minimum, to conserve coal, and to get the fullest value out of every ton consumed.

There were to-day in the United Kingdom about 600 bodies generating electricity for public purposes, apart from the large number of manufacturers, collieries, and others, who generated their own power. The Committee had no doubt that these separate stations could be reduced to a relatively small number, and that the country would greatly benefit by the concentration.

It is believed that as a result of the improvements recommended, and the development which may be expected to proceed from them, the use of electricity for domestic purposes, such as lighting, heating, cooking, and small power, will greatly increase. The cumulative effect of a really cheap supply of electricity, on town conditions in particular, would be most marked. The saving of labour would be great, while the reduction of air pollution by smoke would result in a lower death rate from bronchial diseases and phthisis.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market for the month of June 1918:—

Though our report on the London produce markets for the month of June varies but very little from that of the previous month in the matter of bulk of produce brought forward, or of prices demanded, the approach of the holiday season is being more marked this year than has been the case in previous years since the outbreak of the war. The people have found that war weariness must have a reaction, and are taking what pleasures they can get of a modified form. The produce markets are always affected by the holiday season, and this year is no exception to the rule, purchasers being content to buy only from hand to mouth. The following are some of the chief items.

GINGER.

This article has been advancing in price for some time, and at auction on the 13th of the month the quotations were as follows: common to good common Jamaica 112*s.* 6*d.* to 115*s.* per cwt., and medium to good 120*s.* to 125*s.* Washed Cochin fetched 97*s.* 6*d.*, and Calicut 95*s.*, while 92*s* 6*d.* was paid for Japanese and Sierra Leone. A week later the prices had advanced as follows: washed Cochin 97*s.* 6*d.* to 100*s.*, Calicut 95*s.* to 100*s.*, and Japanese 92*s.* 6*d.* At the close of the month prices were still advancing, the quotations being 110*s.* to 111*s.* for washed rough Cochin, and 102*s.* 6*d.* for Japanese.

SARSAPARILLA.

This drug was in fairly good supply at auction on June 6, when the offerings were: Lima-Jamaica 44 bales, none of which found customers. Of 26 bales of native Jamaica offered, 23 found purchasers at an advance of from 3*d.* to 6*d.* per lb. on previous rates. Fair red, and dull red and yellow, mixed, fetched from 4*s.* 8*d.* to 4*s.* 10*d.* per lb., while for common yellow and part mouldy, 4*s.* 3*d.* per lb. was paid. Seven bales of Honduras were also offered at the same auction, but were unsold.

CITRIC ACID, ANNATTO SEED, CASHEW NUTS, LIME OIL, LIME JUICE, AND TAMARINDS.

At the beginning of the month citric acid was firm at 3*s.* 5*d.* per lb., which price was maintained to the end. At auction on the 6th annatto seed was represented by 60 packages, but no sales were effected. At the same auction 2 packages of cashew nuts were offered, but none sold. West Indian distilled lime oil was quoted towards the end of the month at 6*s.* 6*d.* per lb. while lime juice, which has been in good demand, was fetching from 3*s.* 6*d.* to 4*s.* per gallon. It was stated towards the end of the month that quantities were arriving at Liverpool and Bristol. It was also stated in the middle of the month that West Indian tamarinds were scarce, and much wanted.

MARKET REPORTS.

London.—The West India Committee Circular, June 27.

Arrowroot—1/- to 1.5.
Balata—Venezuelan Block, 3.4¼ to 3.7; Sheet, 3/11 to 4/3.
Beeswax—No quotations.
Cacao—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, 175/- to 195/-.
Lime Juice—Raw, 3/3 to 4/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—5¼*d.* to 6*d.*.
Rubber—Para, fine hard, 3/1¼; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., July 27.

Cacao—Venezuelan, $11·10; Trinidad, $11·75 to $12·40.
Coco-nut Oil—$1·16 per gallon.
Coffee—Venezuelan, no quotations.
Copra—$6·25 per 100 lb.
Dhal—No quotations.
Onions—$4·00 per 100 lb.
Peas, Split—$8·00 per bag.
Potatoes—English, $5·00 per 100 lb.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., July 12.

Cacao—Caracas, 13c.; Grenada, 13c.; Trinidad, 12¾c. to 13c.; Jamaica, 11½c. to 12c.
Coco-nuts—Jamaica selects, $42·00; Trinidad $40·00; culls, $20·00 to $21·00 per M.
Coffee—Jamaica, 9¼c. to 11c. per lb.
Ginger—15½c. to 16½c. per lb.
Goat Skins—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per lb.
Grape Fruit—Jamaica, importation prohibited.
Limes—Importation prohibited.
Mace—40c. to 45c. per lb.
Nutmegs—27c.
Oranges—Importation prohibited.
Pimento—6¾c. to 7c. per lb.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·055c. Molasses, 89°, 4·998c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., July 10.

Arrowroot—$12·00 per 100 lb.
Cacao—$12·50 to $13·00 per 100 lb.
Coco-nuts—$36·00 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $4·75.

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A FORTNIGHTLY REVIEW

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The Harvests of the Sea.

PUBLIC attention in these West Indian islands has been continually directed during the war to the question of increasing the amount of food to be obtained from the land, and in most cases with notably good results. It might be as well if some efforts were made towards greater employment of the harvests of the sea.

With the exception of British Guiana and British Honduras, these western tropical colonies of the Empire are all islands surrounded by seas teeming with fish and other marine creatures, the majority of which might be utilized as sources of palatable and wholesome food. Nowhere, however, in these colonies have there been any other than slight attempts made towards the encouragement and development of fisheries. While so much attention is being directed towards the improvement of the harvest of the land, it might be worth while considering the great potentialities in increasing the food supply existing in the seas surrounding the West Indies.

An exceedingly interesting paper on the Marine Resources of the British West Indies was read by Dr. Duerden, Curator of the Museum of the Institute of Jamaica, at the third West Indian Agricultural Conference, held in Barbados in 1901. He pointed out that everywhere attention is being directed to the utilization and development of the resources of the sea. Government departments are charged with the economical investigation, and the artificial cultivation of many species of fish, lobsters, and oysters, and in most countries of any importance these are attended to with the same amount of scientific care as is bestowed upon the crops of the land. Pisciculture has become a recognized industry and science as much as agriculture.

As is stated above, however, the fishing industry in West Indian waters is only carried out by private and limited concerns. The methods of capture employed are usually primitive in character, and rarely is advantage taken of modern improvements in fishing implements. The quality of much of the

fish is excellent, but the quantity of fish caught is seldom more than sufficient to satisfy local demands for the fresh article, while no provision is made to supply from local sources the dried, salted, or pickled fish which forms such a large item in the dietary of the population. An enormous import trade in salt fish is carried on, chiefly with British North America. In view of this demand for cured fish, the question very naturally arises as to whether some combined effort might not be made to utilize to a greater degree than at present the natural resources of the islands in marine products.

Some years ago an effort was made in Barbados, under the auspices of the Imperial Department of Agriculture for the West Indies, to set on foot the regular curing of fish in that island, especially flying fish, which are often caught in large quantities. This effort at first appeared to meet with some success, but eventually it failed, owing it would seem to the lack of co-operation among the numerous individual masters of fishing boats.

In Jamaica also, in the year 1898, a private Fisheries Development Syndicate, receiving a subsidy on certain conditions from the Government of the island, began operations with a steam trawler in the seas around Jamaica. Trawling however was found to be absolutely impossible except in very limited areas, owing to the almost universal occurrence of coral growth.

It is not likely that the fisheries of the West Indies could ever reach the proportions of those of temperate regions with their vast supplies of cod, mackerel, herring, and allied fish, yet it would appear that fuller knowledge of the habits and life-history of the native fish, the conditions under which they occur in numbers, along with experiments as to the best means of capturing them, together with co-operation, not only in capturing but in curing them, might result in considerable extension of the fishing industry of the West Indies, thus supplying a much-needed increase of local foodstuffs.

As was noticed above, wherever coral is plentiful trawling will be found to be impossible. It would seem also that in tropical seas such bottom flat-fish as are obtained by trawling in northern seas do not exist in any abundance. Line fishing is very successful, but the length of lines employed with advantage is far less than that of temperate seas. Fish caught on long lines in tropical seas are very apt to be snapped off by predaceous fishes, such as sharks and barracoutas. The use of the seine and other nets along the shores and on shallow banks yields good returns, as schools of certain fish, such as the sea-mullet and the jack, are met with in such situations at certain times, but more knowledge is required as to the habits of these migratory species. Probably most of the fish at present caught in these islands are captured in fish pots, many of which are of very primitive construction, though apparently fairly effective for the purpose for which they are designed.

Throughout the West Indies the fishing industry is almost entirely in the hands of private individuals, and is conducted without organization, capital, or enterprise. In most cases the fishermen are content to earn merely enough to maintain existence, and hence pursue their calling in a very desultory manner. Any development of the fisheries should aim at the introduction of co-operation among the fishermen, which might attract capital such as is available for the industry elsewhere.

One of the great needs of West Indian marine industries is scientific investigation. In almost all other countries the fishery organizations have been evolved by government assistance and encouragement. The well-known beneficial result of Imperial support for West Indian agriculture would seem to justify some such support for the marine possibilities of these islands. The products of the sea must be treated in like manner as those on the land. We know what improvements in agriculture have resulted from improved cultivation and introduction of new varieties, and similar results might well be expected from similar attention to marine products.

Besides fish, in the strict sense of the word, there are other harvests which might be reaped in increasing quantity from the tropic seas, if attention was paid to the cultivation of them, and the protection of certain areas for the purpose of increasing the supply. Among these there are large possibilities of increasing the supply of turtle, two species of which, the green turtle and the hawksbill, are valuable, the one for its flesh, the other for its shell. It is quite probable from what is known of the habits of these animals, that the hatching and rearing of them would readily permit of control.

From the ceaseless capture of the adults before they have had time to lay their eggs a greater scarcity must in time result. The female turtle lays from 200 to 500 eggs during the season. But once the young are free they are subject to innumerable enemies, so

that it is probable that only a small percentage attains maturity. If however they were reared under control for a period of probably not more than two or three months, they could then be set free, and from their rate of growth it is supposed that they would be large enough for market purposes in two or three years.

With regard to some other harvests of the seas, such as sea-eggs, bêche-de-mer, lobsters and crabs, and many species of molusca, much might be said as to the extension of interest in exploiting them. On some other occasion we hope to deal more in detail with one or more of these subjects.

THE BRAZILIAN SUGAR INDUSTRY.

According to a British Consular Report, there are thirty-three sugar factories operating in Campos State, Brazil, and the estimated area devoted to cane cultivation is about 98,000 acres, while the production of cane is about 1,055,000 metric tons (nearly 10·8 tons to the acre). This however is not the true ratio, since the land belonging to the usine is not all devoted to cane cultivation, a portion being set apart for cattle raising and agricultural produce.

The production of sugar at these thirty-three factories in 1915 amounted to 54,000 metric tons, plus 2,112,000 litres of alcohol, and 11,688,000 litres of aguardiente (a cheap type of brandy), as compared with 72,120 metric tons in 1914. The production, however, is tending to increase, especially as the recent high prices prevailing for sugar have helped Campos greatly. The factory owners are usually heavily pledged to the big buyers in Rio de Janeiro who make them large advances; they also receive loans from local banks. One reason for this indebtedness is the fact that there is no usine which has been built as a whole. All the factories have been constructed piecemeal, and improvements made, and machinery added from year to year in each usine. Capital has constantly been required for this, and the factory owner has rarely seen himself free from liabilities on account of these advances.

The supply of fuel for the factories is a problem of some importance; all the fuel used is wood derived from the surrounding forests.

SUGAR AND ITS VALUE AS A FOOD.

In a previous number of this Journal (423) reference was made to an article published in a recent issue of the *Louisiana Planter* (May 15, 1918) on the value of sugar as a food for human beings. *Farmers' Bulletin* 535, of the United States Department of Agriculture, publishes an interesting paper which deals very fully with the same subject, the matter being treated under suitable sub-heads.

Regarding sugar in the dietaries of children, it is remarked that the amount of sugar to be given children, and in what form, is a question of much importance. Sugar would seem to be a food especially adapted to children, because of their great activity. Those, however, who have studied the food habits of children seem to agree that sugar should from the very first be withheld from the dish that forms the staple food of the child—that is, the mush or porridge of oatmeal or other cereal. The sugar given the child is better furnished in the occasional simple pudding, in the lump of sugar, or home-made candy, not that its food value is better utilized, but that the whole diet of the child is thus made more wholesome. In sweet fruits, fully ripened, the child finds sugar in a healthful form, and these should be freely furnished.

In the general conclusions reached by the author, it is pointed out that persons who do hard work in the open air can consume great amounts of food containing considerable quantities of sugar, apparently with impunity; but it is equally true that people living an indoor life find that undue amounts of pie, cake, and pudding, with highly sweetened preserved fruit, and sugar in large amounts on cooked cereals, almost always bring on indigestion sooner or later.

In the diet of the undernourished, larger amounts of sugar would doubtless help to supply adequate nutrition. This point is often urged by European hygienists. In the food of the well-to-do it is often the case, however, that starch is not diminished in proportion as sugar is added. That sugar, on account of its agreeable flavour, furnishes a temptation to take more carbohydrate food than the system needs, cannot be denied. The vigour of digestion and muscular activity in each particular case would seem to suggest the limit. A teaspoonful of sugar represents about as much nutriment as an ounce of potato, but, while the potato will be eaten only because hunger prompts, the sugar, because of its taste, may be taken when the appetite has been fully satisfied.

Sugar is a useful and valuable food. It must, however, be remembered that it is a concentrated food, and therefore should be eaten in moderate quantities. Further, like other concentrated foods, sugar seems best fitted for assimilation by the body when supplemented with other materials which dilute it or give it the necessary bulk.

Persons of active habits and good digestion will add sugar to their food almost at pleasure without inconvenience, while those of sedentary life, of delicate digestion, or with a tendency to corpulency would do better to use sugar very moderately. It is generally assumed that 4 or 5 oz. of sugar per day is as much as it is well for the average adult to eat under ordinary conditions.

Power Alcohol.—In *Science Progress*, July 1918, there is a short review of a small book by Mr. Robert N. Tweedy, entitled 'Industrial Alcohol'. It is pointed out that the subject is of great importance for two reasons. First, because the world is using the existing limited supply of mineral oils faster than the rate of supply; and secondly, because the production of denatured alcohol is an important and profitable industry which has almost been entirely neglected in Great Britain. In France the regulations governing denaturation, which made the spirit expensive, have been withdrawn since the war began, and the French Government intends to make alcohol a cheap national motor fuel. The production of power alcohol as an industry hardly exists in the United Kingdom, and of what is manufactured there is no record that any was used previous to 1914 for light, heat, or power. In 1915 the United Kingdom imported 120,000,000 gallons of petrol, though the equivalent quantity of alcohol might have been easily produced at home. Only 5,000,000 tons of potatoes would be necessary, and 600,000 acres, properly cultivated to yield 12 tons of potatoes per acre, would have provided enough of the crop for food, and for the manufacture of the alcohol.

THE CULTIVATION OF THE CASTOR OIL PLANT, AND THE PREPARATION OF THE OIL.

Attention was drawn to the increasing demand for castor oil in an article in the *Agricultural News*, May 18, 1918. This demand still continues, and in many of these islands interest is being taken in the cultivation of the plant.

Mr. A. E. Collens, Superintendent of Agriculture for the Leeward Islands, delivered an interesting address on the subject to the Antigua Agricultural and Commercial Society on August 2, much of which is reproduced below.

According to DeCandolle, in his book 'The Origin of Cultivated Plants', the castor oil plant is a native of Africa, although it is now naturalized throughout the tropics.

The oil has been employed for various purposes from the earliest times. It is especially valuable at present as a lubricant for fast moving machinery, particularly for aeroplane motors, owing to the fact that it is unaffected by a wide range of temperature.

The medicinal use of the oil is well known, but it is also valued in India as an illuminant, burning with a minimum production of soot. It is also used in leather dressing, and for fixing alizarine red in the dying of cotton.

The leaves of the plant are employed in rearing a certain type of silk-worm in India, and recently attention has been paid to this matter in Trinidad. The leaves are also fed to cattle in India, and are said to make excellent forage.

With regard to cultivation, castor seed requires much the same attention and cultural methods as cotton. It thrives best on a rich, well-drained, sandy loam, and will not do well on heavy wet soils, or ill-drained, swampy lands. The root penetrates deeply, and therefore the land requires to be deeply ploughed and well worked.

Castor seeds have an extraordinary vitality; seeds known to have been kept for fifteen years in a stoppered bottle have been sown in Queensland, and have produced healthy plants.

Under normal conditions germination is slow, and the seeds when sown may take a more or less prolonged time to germinate. In modern practice it is advocated that the seeds should be softened by having hot water (almost boiling) poured over them, and being left to soak for twenty-four hours before planting.

The seeds are usually planted 6 feet apart each way, three or four seeds in a hole. They usually germinate within ten days. When the plants are 8 to 10 inches high they are thinned out to one stem in each hole. In the experiments in Antigua the seeds were planted 4 feet by 5 feet. If extensive cultivation is undertaken, a space should be left every eighth row, to allow for the passage of a waggon or cart to collect the seed in harvesting. About 8 lb. to 10 lb. of seed are required per acre.

In from three to four months the plants commence to bear, and will continue in bearing for at least three months. In the tropics the castor plant is a perennial, but it is questionable whether under cultivation it is desirable to allow the plant to continue growing after six months. As the plant ages it is liable to be attacked by scale insects, and apart from that, the difficulty of gathering the crop, and the diminished yield indicate that at the end of six months it should be ploughed up. If left alone, the plant would grow to an inconvenient height. It should therefore be topped by pinching back the main stem when the plant is about 2 feet high; this will cause the plant to throw out more fruit spikes. When the capsules turn brown it is time to harvest the seed. This is done by cutting off the spikes, and removing them to a barn to dry. The seeds should not ordinarily be allowed to dry on the plant, as in some varieties the pods are very apt to burst open automatically.

Several methods are adopted for removing the woody capsule.

In the United States the spikes are spread out on a drying ground to a depth of 6 inches or 1 foot, according to the weather. This drying ground may be either covered or open; the floor should be clean swept or boarded; and it should have a low wall or fence to prevent the seeds from scattering when the capsules burst. If out of doors, means should be available for protecting them from the weather, e.g. by drawing them into heaps and covering them if rain threatens.

The spikes should be turned over frequently in the sun; the capsules soon burst, and in four to five days they will have shed their seed. The seed is then winnowed free from the husks.

In the Bengal gaols the splitting of the shell is done with a machine, which consists of two smooth iron rollers about 2 feet long, placed parallel to one another, and working towards one another by a simple arrangement of cog wheels. One of the cylinders or rollers is fixed, the other movable by a screw adjustment. By means of the latter contrivance the space between the cylinders can be regulated to the required distance, the space being increased or diminished according to the size of the seed about to be spilt. The great point is to give the seed sufficient squeeze so as to split the shell without crushing the kernel. The seed can then be winnowed by hand or by a mechanical shaker.

Mr. Archibald Spooner, several years ago, while in Antigua, experimented in castor oil cultivation and devised a machine with a knapping action, consisting of two horizontal superimposed wooden discs; the top of one was fixed and the lower one revolved. The capsules were fed in on the centre, and travelled along grooves until they finally came in contact with the fixed top disc, when the knapping action caused them to split open.

The yield per acre varies with the different kinds of seeds, and also with the type of land. In Madras, where over 500,000 acres are planted in this crop, the normal return in dry lands is 200 lb. to 300 lb. per acre, while in more favoured localities up to 700 lb. are obtained. In Texas and Florida yields as high as 2,700 lb. per acre are stated to be obtained, while the average yield in the United States varies from 700 lb. to 1 600 lb. per acre. In Colombia 2 lb. per plant is stated to be the average yield, which appears to be somewhat high; 1 lb. of dried seed per plant being nearer the usual quantity.

The following table represents some yields obtained in the Leeward Islands in recent years:—

CALCULATED YIELDS PER ACRE.

Variety.	Antigua.			Nevis.
	1911.	1912.	1913-14.	1917.
Ricinus communis (major)	—	—	—	550
„ „ (minor)	—	—	—	460
Zanzibarensis	980	390	1040	650
Native large	—	—	—	780
Native small	—	—	—	475
3172	1280	450	400	
3173	—	420	560	
3175	900	—	—	
3176	780	330	460	

The yield varies greatly, but this may be partly due to seasonal changes. The rainfall in 1912, for example, was abnormally low, the average being 32 inches as against a normal average of 45 inches for forty-four years.

Two types of seeds, large and small, are met with usually in commerce The large type yields a slightly larger percentage of oil, but the oil extracted from the smaller type is considered more valuable, and is especially used for medicinal purposes.

Recent examinations in the Government Laboratory, Antigua, of types of castor seed obtained locally, indicate the following oil contents in the whole seed (unshelled):—

		Percentage of oil.
Small	local type	49·0
Large	white, slightly speckled seed	56·5
„	Ricinus Zanzibarensis	55·2
„	Communis major (brown speckled seed)	55·8

Castor oil requires considerable purification after expression to free it of albuminous compounds, gummy substances, etc. The following is a crude method which is sometimes employed in these islands. The seed is heated in a pot, and then pounded in a mortar. The pounded mass is then placed in boiling water, and well stirred till the oil rises and is skimmed off; a fresh supply of boiling water is then added, and it is boiled for the second time to recover any remnants of the oil. The oil is then boiled to evaporate any water it contains. This also helps to volatilize acrid principles. The pan is at once removed from the fire when the last drop of water has been evaporated, so as to prevent scorching or burning of the oil.

In the United States the seeds are cleaned from fragments of capsules, etc., but are not decorticated like cotton seed, nor crushed between rollers as are most oil seeds, but pressed whole. The usual process is to express the oil cold, by gradual pressure under a powerful hydraulic press. In the United States of America single pressing is generally used, the cake being trimmed, and the edges repressed with fresh seed.

The oil as it flows from the press is a whitish liquid containing starch, albumen, and mucilage, which are subsequently separated by careful clarifying and refining.

In the United States of America 32 per cent. is the average amount of oil expressed from the seeds, the beans containing a total of 45 per cent.

In England the industry is chiefly centred at Hull, where, after cleaning, the hulls are removed by a slight crushing, and the seeds pulped. The oil is then expressed in hydraulic presses, and afterwards refined with fuller's earth and filtered through a filter press. The press cakes are afterwards steamed and repressed, and yield a lower grade of oil.

An interesting feature to West Indian planters is the experimental trial in India of the Anderson Oil Expeller, a type of oil extractor which has been recently erected in S. Vincent, and which has been found to give excellent results in the manufacture of cotton-seed oil in that colony. Trials with the Anderson Expeller in Mysore in 1915 gave a yield of 44·3 per cent. with seed containing 47·2 per cent. of oil, the residual cake containing 5·05 per cent. oil, which is considerably less than with other types of presses.

The principal by-product of the industry is the castor cake or pomace; this has no feeding value owing to noxious substances contained in it, and is only used as a fertilizer. The toxicity of the cake is due to the presence of a poisonous nitrogenous principle, ricin, which is not an alkaloid, but belongs to a class of unorganized chemical ferments termed phytalbumoses. Ricin is extremely poisonous, 9·3 milligrammes, (·0046 grain) will kill a dog. Curiously enough, fowls are fairly resistant to this poison, and castor cake can, to a certain extent, be fed to them with impunity. Researches are being made in methods of removing this toxin by treatment with high pressure steam. As a fertilizer, however, the pomace is highly valued, and is largely used in India.

In India the greater bulk of the Madras output of pomace, some 80,000 cwt. in 1914-15, is shipped to Ceylon, to be used as a fertilizer, and fetched from 75*s.* to 100*s.* per ton in 1916. Its present value in Great Britain is £16 per ton.

In connexion with the recent boom in castor seed production, it may be noted that over 50,000,000 lb. of seed were imported into the United States of America in 1916. With regard to West Indian and South American exports, Puerto Cabello in Venezuela exported 185,463 lb. in 1917, and recently Colombia sent two shipments of 62,000 lb. of seed to the United States. A contract of 500,000 bushels (roughly 25,000,000 lb.) of seed was placed by the United States Government with a local firm in San Domingo in 1917.

In London, February 1918, the price of castor oil was £80 per ton (about 9*d.* per gallon), and of castor seed £37 per ton (about 4*d.* per lb.). In the United States of America the price in New York, June 1918, for castor oil was 29c. to 33c. per lb., as compared with 9c. to 11c. per lb. in 1904.

THE PORTO RICO COLLEGE OF AGRICULTURE AND MECHANICAL ARTS.

This college is situated in the neighbourhood of the town of Mayaguez, and is a department of the University of Porto Rico. It is one of the fifty colleges known under the name of Land Grant Colleges, to which the Government of the United States apportions the sum of $50,000 annually for the purpose of instruction in agriculture and mechanical arts. The courses of instruction are as extensive and thorough as those which are offered by the universities of the United States. The young men of Porto Rico have no need to go to the United States to study agriculture or engineering, since they can obtain the same instruction in their own country.

It is to be noticed that a great portion of the work of the college is carried out practically in the fields, in the workshops, and in the laboratories. The aim of the college is to turn out efficient workers. The students who finish their collegiate course obtain the degree of Bachelor in Agricultural Science, in Sugar Chemistry, in Civil Engineering, or in Electrical or Mechanical Engineering, according to the subject to which they have devoted their attention.

The prospectus of the college for the year 1918-19, from which we obtain the above information, indulges in a little self-gratulatory retrospective. In enumerating the reasons why the young men of Porto Rico should in increasing numbers take advantage of this means of education, the prospectus states that all the former graduates of the college are in good positions, and are in receipt of good salaries. The Department of Extension of the Experimental Stations of the United States has found situations for all the graduates of the agricultural section which the college has been able to furnish. The Dominican Republic has taken all the graduates which the college has recommended and asks for more. All the students who are taking the second and third year of the sugar chemistry course are working in central factories in the island, and the college has been assured by many other central factories that they will gladly find situations for all such students as soon as they have completed their course.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. Plant distribution during the month of July included: limes, 4,350; coffee, 100; vanilla, 100: eucalyptus, 40; budded citrus, 46; miscellaneous, 14. Mr. J. Jones, the Curator, referring to staple crops, states that limes are now ripening rapidly; the local price for ripe limes has dropped from 5*s*. to 4*s*. per barrel. A very heavy squall was experienced on the evening of the 11th. The rainfall recorded for the month was 11·28 inches.

MONTSERRAT. The Curator, Mr. W. Robson, states that drought continued throughout the month of July, consequently very little progress was made by the plots at the Experiment Station. Plant distribution included: bay plants, 1,960; black-eye peas, 2 lb.; various beans, 16 packets. In the Botanic Station five distillations of bay leaves were made. The continued dry weather has put an end to any hopes of their being a considerable first crop of cotton from early planted fields. The season, so far, is undoubtedly the worst in the history of the industry. The proportion of stained cotton in the 1917-18 crop is now seen to be 6·8 per cent., as compared with 7·7 per cent. in the crop of the previous year. A case was met with in a remote district, where several acres of two-months-old cotton was being dug out on account of severe infestation by leaf-blister mite, caused by neglect to destroy old infested plants in the neighbourhood. This emphasizes the need for more strenuous enforcement of the Cotton Ordinance. On the representation of the Curator, special inspectors are to be appointed to see that the law is more effectually enforced.

The Assistant Curator, Mr. A. W. Gallwey, from Antigua, assumed his duties on July 8.

The rainfall recorded at Grove Station for the month was 3·45 inches: the total rainfall for the year to date is 25·46 inches.

ANTIGUA. Plant distribution during the month of July was as follows: eucalyptus, 310; miscellaneous economic, 17; decorative, 10; black-eye peas, 1,792 lb.; cotton seed, 429 lb.; vegetable seeds, 3 packets; bread-and-cheese seeds, 1 lb. In consequence of the protracted dry weather a considerable amount of the time of the labourers employed in the Botanic Station was taken up in carting water from adjacent ponds to keep the nursery stock alive. In reference to staple crops, Mr. Jackson states that practically the whole of the cane crop has been reaped. A large proportion of the canes grown on muscovado estates has been converted into syrup. Returns were poor, and an exceptionally short crop has been made. The young cane crop is beginning to feel the effects of the protracted drought. This is also the case with ratoon canes in various parts of the island. The early planted cotton, on the whole, looks very promising. Caterpillar attacks were experienced during the month. Only 2·12 inches of rain fell during the month. The total rainfall for the year to date is 19·78 inches.

ST. KITTS. Mr. F. R. Shepherd writes to say that the past month was most unfavourable for crops, very high winds and low rainfall prevailing. Only 2·46 inches of rain was registered during the month. The young cane crop has made no progress, and unless heavy rains soon set in, the prospects for the next season will be very poor. The ratoons, having received no artificial manures up to the present, are very backward, and it is questionable whether it will be profitable to apply sulphate of ammonia later on, when it is received Cotton picking has begun on the estates in the north where cotton was planted early, and there is promise of a good return in spite of the dry weather.

NEVIS. The Agricultural Instructor mentions a continuation of dry weather during the month of July. The following comprised plant distribution during the month: cotton seed, 34 lb.; sweet potato cuttings, 15.000; vegetable seeds, 24 packets. In addition, 6 lb. of Paris green was distributed. Mr. Howell states that the cane crop throughout the island continues poor, and a very short crop is expected. The cotton crop is looking a little better, but the greater part is late. Picking has begun in some of the early planted fields, but cotton stainers have already made their appearance. Boll dropping has occurred to a fair extent in some of these fields, and many of the fallen bolls have been observed to be attacked by internal boll disease. Cotton worms attacked many of the fields during the month, but they were kept in check by the use of poison. Provision crops are doing fairly well, but are much in need of rain.

A meeting of the Agricultural and Commercial Society was held on July 17 to discuss the possibility of placing the cotton industry on a more stable footing. The questions of advances, insurance against hurricanes, and a close season, were also discussed.

The rainfall recorded for the month totalled 4·08 inches, for the year to date, 23·03 inches.

AGRICULTURE IN BARBADOS.

August opened with a very rainy day. As much as 3 inches fell in some districts, and we have heard of no district in which less than 1½ inches were registered. Again on the 5th instant there was a day of rain, and on this occasion the southern part of the island seems to have been more highly favoured than other parts.

The recent rains were very acceptable in the drier districts where for almost a fortnight there had been no rain, added to which the rather high breezes had begun to nip the leaves of the various crops.

The last fortnight has seen marked progress in the development of the cane crops, particularly in those parishes which are not subject to spells of drought, and the growth would have been still more noticeable if there had been no scarcity of artificial manures. At last the expected cargo of nitrate of soda has been received. This was rapidly removed from Bridgetown, and there has been an immediate application of it.

The arrival of artificial manure has been very opportune, as the plant canes in some districts were so forward that further delay would have made it almost impossible to get through without injuring them.

The ratoons too in some fields, although they had been bravely holding out had begun to show signs of lack of vigour. The greatest difference is observable in the development of those fields which have received an application of artificial manure as compared with those which have had to wait their turn.

In respect to plant canes, all the seedlings are coming on satisfactorily. The foliage of the Ba. 6032 is not of a deep green, and one is tempted sometimes to suspect it of unhealthiness, but on closer examination it is found that this is its natural hue. The B.H.10 (12) continues to develop as rapidly as was noted in our recent reports, and seems to justify the confidence which is being placed in it. The vigour of this seedling compels us strongly to recommend planters to treat it very liberally. Our soil at present has no reserve. The food supplied is practically taken out by each crop

Indeed the tendency of modern systems of manuring is not to manure the land, but to manure for each crop only. We do not question the correctness of such a system, so long as each crop receives a supply sufficient to bring it to healthy maturity.

There is a much larger area under the B.H.10(12) for the crop of next year than was at first thought, and we have noticed several fairly large nurseries of the seedling being grown for the next planting season.

The heavy tonnage given by our seedlings as plant canes in the black soil demands that there should be recuperation before another crop of canes is grown. The increased value of a catch crop from a field which has only grown one crop of canes compensates to some extent for the amount which is realized by the second crop of canes. There is also the danger of exhausting the soil, and thereby exposing it to the inroads of disease. There is too in addition, but little chance of resting fields where cropping is so continuous.

The fields of B. 6450 are not disappointing, and, as this is a cane which develops later than either the Ba. 6032 or the B.H.10(12), we cannot as yet compare it with the more forward condition of its rivals.

Since our last report the putting out of farmyard manure has been generally started. One can hardly drive in any district without meeting roads of this valuable stuff being carted in different directions. This application is being made from the yard pens. The field pens are not yet fit for distribution.

Fodder is fairly plentiful, and the supply of cane shoots is only now being finished up. These have been in some instances supplemented by fields of imphee, and now the pastures are ready to yield their supply. Fodder is also being sold at a moderate price in Bridgetown, as the peasants are disposing of their crop of Guinea corn fodder grown since the incoming of the rainy reason.

The Indian corn crop has proved satisfactory practically everywhere, and reaping has been started. As this crop ripens very rapidly, the next few weeks will see its general ingathering. We regret to record that many peasants have had to sell their young corn crop as fodder, in order to save it from the depredations of thieves.

The scarcity of potatoes is being relieved, but it will still be a few weeks before a fair supply can be placed on the market. Some estates are selling to their labourers only. We cannot object to this, and we are informed that this has had the effect in some instances of increasing the volume of labour. Many villagers who were only very transient labourers have given general assistance on neighbouring estates, in order to become eligible purchasers of potatoes. (The *Barbados Agricultural Reporter*, August 10, 1918.)

NATIVE OIL PALMS OF BRITISH GUIANA.

The discovery of new sources of raw material, or the further development of old sources is the only means of overtaking the large and ever-growing demand for vegetable oil. Any information of a new source of vegetable oil is welcome, more especially if such be a natural forest product, and not a cultivated one. In a paper in the *Journal of the Board of Agriculture of British Guiana*, April 1918, Mr. L. S. Hohenkerk, Forestry Officer in the Department of Lands and Mines of that colony, draws attention to the possibilities as an oil producer of the Kokerit palm (*Maximiliana regia*) which is widely distributed throughout easily accessible forest areas of British Guiana.

The Director of the Imperial Institute has furnished a report on a small sample of kokerit fruit and oil forwarded to him for examination.

The kokerit fruits are about 1½ to 2 inches long, and from ¾-inch to 1 inch in diameter. The fruit consists of a soft, pulpy pericarp containing oil, and the nut, a hard woody shell enclosing two or three kernels, which resemble African palm kernels in consistency.

The pericarp yielded 17·1 per cent. of a semi-solid orange-red oil, resembling African palm oil in appearance, but differing somewhat from it in chemical composition. The report was of opinion that this pericarp oil would find a ready market, if it could be obtained in quantity.

The kernels yielded 64·1 per cent. of a fairly hard cream-coloured fat, with an odour resembling that of coco-nut oil, and in chemical composition similar to African palm kernel and coco-nut oil. It was stated in the report that there can be no doubt that kokerit kernels would fetch the same price as palm kernels, or possibly a little more.

The meal left after extraction of the oil from the kernel was pale brown, with a mild and not unpleasant taste, somewhat suggestive of coco-nut. It should have a feeding value about equal to that of palm kernel cake, and somewhat lower than coco-nut cake.

The question therefore is to ascertain whether the fruit can be obtained in British Guiana in large quantities at a price which will admit of their being sold in Liverpool at about the same price as palm kernels.

From a survey of about 90 square miles by the Forestry Officer, he has computed that the number of kokerit palms in the Canje River district alone would not be less than 511,785 fruiting trees, which would produce, even supposing a tree gave only one bunch of nuts per annum, of an average weight of only 50 lb., a weight of fruit equal to 25,589,250 lb., which ought to yield something like 1,108 tons of oil. Even at the pre-war rate of palm oil at £22 per ton, the value of this oil would be £24,376 per annum. Mr. Hohenkerk considers that the best plan for exploiting this product would be to obtain machinery for cracking the shells and extracting the oil in the colony, and then to export both the oil and the meal to the home markets.

Machinery for the purpose is however unobtainable at the present time, but an export of kokerit kernels might be started in a comparatively short time. The aboriginal Indians, who reside on the banks of the rivers in the districts where the palms are eommon, might be interested in this industry. Both men and women could collect the nuts, either while returning to their homes from their fields or work places, or by making special journeys to the palm trees in their neighbourhood. The nuts could be sun-dried and broken, the kernels picked out and packed into baskets by women and children, and the baskets conveniently shipped by steamer, launch, or boat, for sale to one of the firms in the colony who are willing to buy them.

In this connexion Mr. Hohenkirk says that he himself has seen in the fruiting season hundreds of tons of these nuts, cleaned of the pericarp, lying under the trees in the region of the Canje and Berbice Rivers, and he thinks that it would be more feasible to collect only the fallen nuts than to strive to obtain the whole fruit.

There are other palms also growing in numbers in British Guiana, the fruits of which are known to yield from both pericarp and kernel edible oils of a high value. For instance, the Awarra (*Astrocaryum tucumoides*), the Akuyuro (*Astrocaryum tucuma*), and the Turu (*Oenocarpus bacaba*), along with several others, which it might seem advisable to get reports on.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

CLERICAL STAFF.

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Typist	Miss B. Robinson.
Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.

†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial points out how beneficial it would be to these islands, if a larger supply of food was obtained from the seas around them, by improvement in methods of capturing and curing fish.

Attention is drawn under Insect Notes, on page 266, to the considerable amount of success in control of the cotton stainer, which has been obtained in St. Vincent by systematic destruction of the wild host-plants of the insect.

The importance of producing strains of plants resistant to disease is pointed out in the article under Plant Diseases, on page 270.

Cotton in Africa.

In an address given before the Royal Geographical Society, June 10, 1918, on 'The Backbone of Africa', Sir Alfred Sharpe, a former Governor of Nyasaland, foreshadowed a new source of supply for Lancashire cotton manufacturers. It was quite certain, he said, that sooner or later America would be unable to supply the demand of British manufacturers, but there was no reason why Africa should not step into the breach in the matter of the supply of raw cotton. The plains of the White Nile, the Blue Nile, and the Atbara only required irrigation on a large scale to make the country one of the largest producers in the world of cotton, grain, and other tropical and sub-tropical products.

The American Bureau of Standards and Sugar.

The *International Sugar Journal*, July 1918, gives prominence to the fact that fiscal Bills lately before the American Congress for the year 1918-19, provide for the appropriation of £4,000 for the use of the Bureau of Standards, to be utilized for the standardizing of sugar-testing apparatus, and the developing of technical specifications for the various grades of sugars, with particular reference to urgent problems made pressing by war conditions, especially involving the standardization and manufacture of sugar. The purpose of the Bureau, in short, is to make a strictly scientific classification of the different grades of sugar, and place the technical standardization of the sugar industry in general on a proper scientific basis, as well as to solve the problems incidental to the collection of revenue on sugar.

Besides the above appropriation, there is one of £2,000 to be used in the development and improvement of American strains of sugar-beet seed, and for the establishment of a permanent beet seed industry in the United States.

It is also interesting to note that the agricultural experiment stations in Hawaii and Porto Rico have each been voted £9,000 for maintenance expenses, while a new station projected for the Virgin Islands (formerly the Danish West Indies) receives a grant of £3,000 for the year.

West Indian Dye-Woods.

The following note taken from the Demerara *Daily Argosy*, August 5, 1918, is of interest in connexion with West Indian industries.

There is every indication of a great development in connexion with the dye-producing woods of British Guiana and the West Indian islands, consequent on the requirements of American manufacturers.

It is stated that the American Government wants particularly great quantities of woods that give a yellow dye which is much in demand for khaki, and these woods are not available in sufficient quantity in the United States.

Among the woods that are producing this yellow dye is fustic, which abounds in the West Indies and in British Guiana.

In order to ascertain the resources of the West Indies and British Guiana in this wood, Mr. E. B. Fairweather, who holds a contract to supply fustic to American manufacturers, and who is on a visit to these parts, was recently for a short time in British Guiana, awaiting the granting of licenses by the United States Government for the shipment of fustic to America. He left a few weeks ago for Trinidad, whence he will ship about 50,000 tons of fustic.

With regard to British Guiana, application was also made for the shipment of wood to the United States, but some hitch occurred, and the export license was not allowed up to the time that Mr. Fairweather left the colony. While he was there he interested himself in the logwood industry, and it is understood that he is returning, on completion of his business abroad, to initiate schemes for the development of this industry.

New Sources of Food Supply.

A note in the *Geographical Journal*, June 1918, points out that there is need of paying attention to new sources of food supply by those concerned with increasing the world's food both during and after the war. Apart from animal food, much may be done to supplement the staple diets of the human race by judicious cultivation of other vegetable products besides cereals. The agricultural development of the United States is taken as an example of what has been the custom of agriculturists in the past. Cultivators have usually adhered to the staple crops to which they have grown accustomed, and thus great areas—the corn belt, the wheat region, the cotton belt—have been occupied by these particular crops, because of the suitability of the soil and climate to their production. When the land suitable for these crops was fully occupied, resort was not had to land of other character in the same region by using it for other products, but the cultivators either spread out into new regions, leaving much of the land in the older districts uncultivated, or wasted their energies in vain endeavours to grow the old staples upon unsuitable ground. With the rapid diminution of new land, and the increase in population, new methods must be adopted, so that the productive power of every kind of soil may be drawn out in full measure. Already much has been done in the great arid region of the west by 'dry farming' methods, both by revising the methods of tillage, and by cultivating a different set of plants, or special varieties suited to dry conditions. The wet lands, especially in the south-east, present a different problem. It is calculated that there are about 80,000,000 acres of such lands now useless because too wet, and though much may be done by drainage, a wise selection of crops will do more. An extended cultivation of rice, for instance, may be well looked for in this region, but besides that familiar crop, certain species of Aroideae with tuberous roots, such as the dasheen, particularly suited for cultivation in damp soil, would form a good substitute for potatoes, and afford a large and wholesome additional supply of food.

Agriculture at Oxford.

In *The Times*, May 30, 1918, attention is drawn to an important statute promulgated in Congregation at Oxford on May 28, the object of which is to establish a new School of Agriculture and Forestry at the University. The novel feature of the school proposed is that it will be neither a pass nor an honour school according to the old definition, but will be a pass school leading up to a degree in arts, in which candidates adjudged worthy will receive 'distinction'.

The statute was introduced by the Warden of All Souls College, which college it may be interesting to note has a sort of connexion with Codrington College, Barbados, through the benefactor of both, Sir Christopher Codrington. In introducing the statute, the Warden explained that it grew out of a suggestion of the Board of Agriculture, and that it was designed to provide education especially suitable for men who would become owners or managers of land, not a few of whom go to Oxford.

This new move appears to show that the older English Universities are really beginning to recognize that classics and mathematics do not constitute the only subjects which are worth studying.

Forestry in Cyprus.

In a recent number of this Journal the editorial pointed out the benefits that would accrue to these West Indian islands by more attention to scientific forestry. An article in the *International Review of the Science and Practice of Agriculture*, April 1918, on Agriculture and Forestry in Cyprus, gives a striking instance of the progress made in forestry in that island.

In ancient days Cyprus was known to be rich in timber, and its mountain districts were clothed with trees. In 1878, when Cyprus passed under British control, the condition of the so-called forests had become deplorable under centuries of Turkish misrule. Steps were at once taken to appoint Government Forest Officers with scientific knowledge in order to remedy this condition, and to stop further destruction of the forests remaining. The forest areas were gradually delimited and settled. They now extend to some 700 square miles.

Owing to the fact that very small sums were for some years voted annually to the Department of Forestry, the work of protection was the only course opened to the officers, and no progress in artificial re-afforestation was made for nearly thirty years after the British occupation of the island. Since 1907, however, special tree planting has made considerable progress, and there is no doubt that the forests of Cyprus are now on the high road to recovery, and are likely to become an added source of beauty and prosperity to the island. It may be interesting to note, although the connexion between forests and rainfall is open to question that the rainfall of Cyprus appears of late years to have increased

INSECT NOTES.

COTTON STAINER CONTROL IN ST. VINCENT.

An editorial in the St. Vincent *Sentry* for July 28, last, comments on a resolution passed by a meeting of the Board of Directors of the St. Vincent Electric Light Company, Ltd., in which the Government is urged to adopt the most stringent measures for enforcing the provisions of the Cotton Stainers Ordinance and the Cotton Diseases Prevention Ordinance, with respect to the close season and the destruction of 'John Bull' and 'Silk-Cotton' trees which provide food for the cotton stainers. Everyone interested in cotton growing will approve of this.

The passing of this resolution by the Electric Light Company has been made the occasion for reference by the *Sentry* to the cotton stainers, and the work of the cotton stainer control, as if this was a new pest, and the work of control had not yet been started; instead of which the cotton stainer has been known in St. Vincent as a pest of cotton during the entire period of fifteen to sixteen years that Sea Island cotton has been cultivated as a crop in that island; and the work of stainer control has been efficiently carried out during the past two cotton seasons. In the earlier days of cotton cultivation in St. Vincent, and, in fact, in all the West Indian islands where cotton stainers occur, the exact nature of the damage done by these insects to cotton was not realized. About three years ago it was found that the cotton stainer was closely associated with the internal boll rot, which was the most destructive disease of cotton in St. Vincent.

In this connexion the work of Mr. Sands, the Agricultural Superintendent, Mr. Harland, the Assistant Superintendent, and Mr. Nowell, the Mycologist on the Staff of the Imperial Department of Agriculture, should be referred to. This work has been published in recent numbers of the *West Indian Bulletin* and the *Agricultural News*, and recorded results go to show that the food-plants of the cotton stainer in St. Vincent are now known, and that the destruction of large numbers of 'John Bull' and 'Silk-Cotton' trees has resulted in a very great reduction in the numbers of the cotton stainers.

As a direct consequence of this work the cotton crop of last season (1917) was much better than that of any recent year.

The existence of wild trees in the mountains, to which the cotton stainers resort for food in the absence of those plants which are preferred by the insects, has already had the consideration of the Agricultural Superintendent, and references to this aspect of the matter are to be found in the published accounts mentioned above.

In connexion with the appearance of cotton stainers in the fields of the present growing crop, the Imperial Commissioner of Agriculture has received a letter from the Agricultural Superintendent from which the following information is obtained.

The infestation of certain young cotton fields (May-planted), which were investigated in the Windward and Leeward districts during this month (July), undoubtedly had their origin, not from the forests, but chiefly from the vicinity of buildings on lands near to which cotton had been grown. A few of these insects may have survived on bushes such as those described in the papers in the *West Indian Bulletin* (Vol. XVI, pp. 245-6, and Vol. XVII, p. 47).

On one large estate inspected in the Windward district, in the neighbourhood of buildings used for dealing with seed cotton, there was discovered a very large number of cotton stainers. Efforts had been made from time to time, but not systematically or very successfully, to collect the pest since the cotton stalks were cut down in the month of April. On July 11, the Cotton Inspector reported that the bush near the buildings was cut and burned, and he had observed that a very large number of stainers were put to flight. On the morning of the next day a heavy infestation of the cotton plants at the Experiment Station and about the buildings of the Government Ginnery was reported. No insects had been observed on the previous day in either of these places. The estate was situated 3 miles to windward of the station, and a high easterly wind was blowing on the date mentioned. On the 16th the estate was visited, and very few stainers were to be found; these were being trapped successfully by the methods which had been advised.

In the Leeward district another case occurred where the pest arrived about the 12th or 13th in considerable numbers; this infestation is attributed to the same or a similar source.

A third case investigated indicated that sufficient care was not exercised in the control of the stainers in the months of May and June in the vicinity of buildings; the pest was reported present at this place during May.

Close attention has been given to the food-plants of this insect. It may be found necessary to deal with the 'bois-flot' or 'cork wood' (*Ochroma lagopus*). The 'Mountain John Bull' or 'Mahoe Cochon' (*Sterculia caribaea*) is not considered to be sufficiently important at present to make necessary an attempt to eradicate it.

It is stated that it was not possible to enforce the destruction of the old cotton stalks by the end of March, last, notwithstanding that the Cotton Diseases Prevention Ordinance of 1911 was amended on February 11, 1918, to make the month of April constitute a close season. On some estates cotton picking was in progress at the end of March, and at many places the cotton stalks were not destroyed until the end of April. Cotton planting was started early in May, therefore there was no close season. The season was a good one in that there was little dry weather experienced, and the cotton stainer took every advantage of the facilities it was offered for tiding over the period from May to July.

It is only by systematic trapping of the pest in the months of April, May, and June, and the strict enforcement of the law relating to the close season, that a more effective control of the pest can be hoped for in the future. If there had been 'Silk-Cotton' and 'John Bull' trees present this season as formerly, the stainers would have been carried over in enormous numbers, and by this time the whole industry would have been in danger of extinction. The flights of the pest that have been reported so far have been quickly controlled, and the insects have not been allowed to breed to any extent.

The Agricultural Superintendent has spent a great deal of his time during the past three months in closely studying the pest and the best methods of trapping it, and two other officers have devoted a large part of their time in visits to estates and small holdings in connexion with control

work. No efforts have been spared to bring to the notice of the planters the necessity of dealing with the insect whenever and wherever found.

Although there was a very heavy infestation of cotton stainers on trees of several kinds near the Botanic Gardens in May and June, these have all been destroyed by means of traps and by the use of the Primus torch, and for the four weeks previous to writing no stainers had been found on the traps which were put down in the places where the insects had been killed in large numbers. At the Experiment Station and at the Government Ginnery there are no stainers, owing to the careful and systematic trapping and destruction which had been practised.

This account shows plainly that a very considerable and important amount of work has been done in St. Vincent on the control of the cotton stainer, and it indicates that the great need at present is for co-operation by the planters and all interested in cotton growing with the Government in its efforts to destroy the food-plants of the insect; and to establish a close season during which no cotton shall be grown in the island.

In order for a close season to be a success, the law must be most strictly enforced, and when the appointed time arrives, all cotton must be removed from the fields, and disposed of in the manner decided upon as being the most suitable. No compromise is possible, if the cotton industry is to be safeguarded. This also applies to the destruction of the food-plants of the insect. It has been demonstrated that the destruction of food-plants is capable of greatly reducing the numbers of the stainers which can tide over the non-cotton season, and now it is required that constant care be exercised to prevent new growths of the plants that have already been destroyed, and to apply the provisions of the law to other plants as soon as they are found to provide sufficient food to allow these insects to live and breed during this time.

Another point raised in the editorial menti ned in the first part of this article is the matter of natural enemies of cotton stainer. This aspect of the case has received much study by the officers of the Imperial Department of Agriculture, and the officers of the local Departments in all those islands of the West Indies where cotton is grown. Cotton stainers have also been studied in this respect in many other countries, always with the same conclusion, that the group to which cotton stainers belong comprises insects which have very few natural enemies. Stainers themselves are particularly free from natural enemies, and it is certain that in the West Indies there are none which can be expected to exercise any satisfactory degree of control over this pest.

The resolution passed by the Board of Directors of the St. Vincent Electric Co. Ltd., indicates that they were alive to the need of continued attention to the control of cotton stainers by the Government, and of co-operation by everyone interested in the cotton industry in that island. The comments on the subject by the *Sentry* indicate that there are those who have not kept themselves informed as to the work that has been, and is being done in this connexion.

H.A.B.

THE EGG PLANT.

This plant is rather commonly cultivated throughout the West Indies under various names. Perhaps the commonest is Melongène, or some corruption of it, which is evidently derived from the botanical name of the species *Solanum melongena*. This plant thrives well in these islands, perhaps because it is originally a native of the tropics, and has not long been submitted to the process of selection in temperate gardens. As was noticed, however, in the article under Plant Diseases in the *Agricultural News*, December 29, 1917, it is susceptible to a bacterial disease known as wilt. This trouble may be met by grafting the egg plant on wild species of Solanum. The one used for this purpose in Jamaica is said to be *Solanum mammosum*. In 'Nature Teaching', by Sir Francis Watts, it is suggested that *Solanum torvum*, another wild plant of the same genus, should be used for this purpose. The process is as follows: a wild plant of a convenient size is selected as the stock. A piece of the stem of the stock is then cut off, and with a sharp knife a longtitudinal cut to the depth of about 1½-inches is made into the stump, and a wedge removed. The scion, a small branch of the egg plant about twice as thick as an ordinary lead pencil, and about 4 inches long, is tapered to fit the cut made in the stock, and most of its leaves trimmed off. The scion is then inserted into the stock, care being taken that the cambium layers or inner bark of stock and scion are in contact, at least in one place. The graft is then wrapped round with twine or woollen yarn. A large leaf should be tied like a cap over the scion and the top of the stock, so as to shield the joint from the rays of the sun. As this is a soft, quick-growing plant, there is no need for the use of grafting wax or tape, the plant remaining moist until union has taken place.

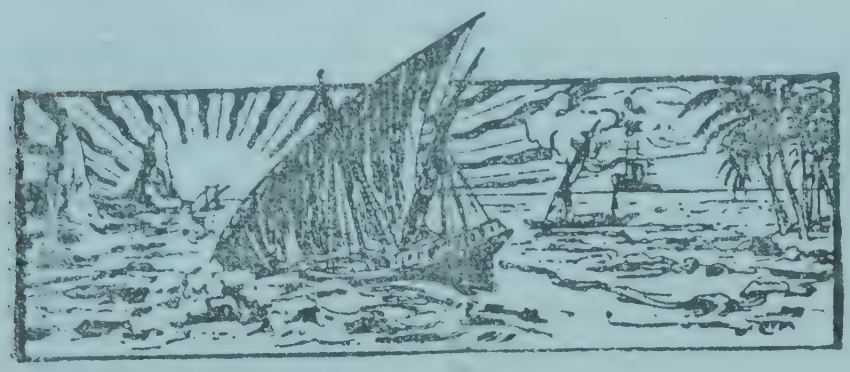
It is considered advisable to pick off any flowers which form during the first two or three months, in order to allow the plant to make vigorous vegetative growth.

It is also reported from Jamaica that buds of the egg plant take readily when inserted into the wild stocks.

It would seem that this method of growing egg plants is far preferable to permitting the plant to depend upon its own roots. In the first place, the stock is perennial, and therefore bearing is continual. In the next place, the raising of seedlings is attended with certain difficulties, not only owing to insect attacks, but, as has been before stated, to their susceptibility to wilt infection. The use of a more vigorous and hardy stock of the wild species for grafting with scions of improved varieties of the garden vegetable offers, it would seem, every advantage in the way of protection against the foregoing adverse conditions.

Should the fruit trade of the West Indies in the future attain dimensions which are desired, another advantage connected with this method of the propagation of the egg plant suggests itself. The grafted plants are perennial, as was noticed above, and therefore by pinching off the flowers during the season when the fruit is not desired to be shipped, the energies of the year's growth could be concentrated upon production in the months when the market offered most remuneration, for instance, during the early winter months before the Florida crop is ready for the northern markets.

In Jamaica *Solanum mammosum* is known as 'shushumber', and in many of the smaller islands *Solanum torvum* is known as 'plate bush' or 'turkey berry'. Both of these species have a strong erect habit, growing 5 or 6 feet in height. The berries of *Solanum torvum* are occasionally used in cooking, as a substitute—a poor one it may be stated—in place of tomatoes. These plants are really common weeds along roadsides and in waste places, so that there would be no difficulty in obtaining a plentiful supply of stocks for grafting purposes.



GLEANINGS.

The Food Production Department in England has directed the attention of owners and occupiers of land, not in use for the growing of food crops, to the sun flower, the seeds of which are valuable both as a source of oil and for poultry food. The ash obtained from burning the sun flower stems, leaves, and heads is rich in potash. It is important that this valuable source of potash should be fully utilized. (The *Journal of the Board of Agriculture*, May 1918.)

In a previous issue of this Journal attention was drawn to the manufacture of industrial alcohol in Natal. *The Board of Trade Journal*, June 6, 1918, states that it is now announced that the first instalment of 10,000 gallons of alcohol motor fuel has been placed on the market. This is being succeeded by another instalment of 20,000 gallons. Ether is added to the alcohol to render the fuel more volatile to facilitate starting up.

The New Zealand *Journal of Agriculture*, April 20, 1918, has an interesting article on the influence of bees on fruit crops. It is stated that many fruit growers in the United States so recognize the great importance of bees in the pollination of the flowers of their fruit trees, that they pay as high as $5 per colony to bee keepers who are willing to bring their bees into the orchard during the blossoming period of the fruit trees. The fruit growers consider that by renting colonies of bees on such terms each season they get good value.

According to *The Board of Trade Journal*, July 18, 1918, the quantity of coffee exported from Venezuela in 1917, as shown by figures supplied by the British Vice Consul at Caracas, was 728,041 bags, as compared with 833,791 in 1916. These totals are for the whole country. The proportion of the total exports shipped by German firms was considerably lower than in 1916. In this connexion the Vice-Consul reports that German firms are now buying up coffee with the intention of storing it for shipment at the end of the war to the depleted market of Germany.

In the House of Commons, Sir R. Winfrey lately gave interesting particulars respecting research work in animal diseases, and the immunization of animals from native and tropical diseases. He stated that the Board of Agriculture's Laboratory at Addlestone is now practically completed, and several scientific investigations have been undertaken there, in which useful results have been obtained. The best method for immunizing British live stock against tropical diseases before export are also continuously under consideration, and good progress has been made in that study. (*The Field*, July 27, 1918.)

A cable message was received from India on July 29, to the effect that the Indian Government had prohibited the exportation of castor oil. This will mean that the already restricted supply of castor oil will be still more restricted, and the price will rise to a very much higher figure than at present. (The Demerara *Daily Argosy*, August 5, 1918.)

From the Rothamsted Experiment Station advice is given to farmers that in view of the restricted supplies of nitrogenous manure every possible care should be taken of the liquid manure. Long experience of farmers, and direct experiments by investigators alike, prove its usefulness as a fertilizer. (The *Journal of the Board of Agriculture*, May 1918.)

A note in *The Field*, June 15, 1918, states that there are indications that this year's fruit crop in England will be insufficient to supply the jam factories. In view of the great importance of sufficient supplies of jam for use by the Navy and Army, and by the civilian population, the Food Production Department is appealing to all cultivators to plant immediately, on as large a scale as possible, vegetable marrows for supplementing the fruit supply. The department is informed that thousands of tons of ripened vegetable marrows can be utilized during the coming season by the jam manufacturers.

Dr. Britton, the well known botanist, published in March last, a *Flora of Bermuda*. The *Journal of the New York Botanical Garden*, in a notice of this publication, says that the work contains descriptions and illustrations of all the native and naturalized flowering plants, ferns, mosses, and hepatics of Bermuda, together with descriptive chapters on the lower cryptogams. In addition to the kinds of native and naturalized plants, brief descriptions are given of the cultivated plants of the colony. This work, says the journal, is perhaps the most complete description of all the plants of a small area that has ever been published.

The effect of the flowering of potatoes on the development of the tubers seems to be that the effort of the plant to provide for its reproduction by means of seeds results in a corresponding weakness in its root growth, and in the size and numbers of the tubers. Referring to experiments on this question, the editor of the *Queensland Agricultural Journal*, in a paper published in the *Tropical Agriculturist*, April 1918, on the cultivation of the potato, stated that the crop from which the blooms were not cut at all gave the worst yield, whereas the best crop was yielded by plants that had been prevented from blooming by being topped at frequent intervals.

At a meeting of the Royal Society of Arts, May 1, 1918, a paper was read by Mr. George Martineau, C.B., on 'Sugar from Several Points of View'. In the discussion which followed, the Chairman Lord Balfour of Burleigh, said that if the resources of the Empire were to be developed, a certain reasonable continuing security must be given for a period long enough to encourage the investor to put his money into the industry. He did not think it was impossible for this country to do with cane sugar what the Germans had done with beet root sugar, because in all probability the one was as susceptible of improvement on right lines as the other. (The *Journal of the Royal Society of Arts*, June 14, 1918.)

THE PORTO RICO AGRICULTURAL EXPERIMENT STATION.

The report for the year 1916, of the Porto Rico Agricultural Experiment Station, which was issued on February 5, 1918, from the Office of Experiment Stations, United States Department of Agriculture, consists of six separate reports of officers on the staff of the Station. The first, which is by Mr. D. W. May, the Agronomist-in-Charge, deals with the general aspects of agriculture in the island. The year reported on witnessed an increase in agricultural production in Porto Rico, with excellent yields of most crops, and high prices for the products. Especially has this been the case with food crops. Mr. May notes with approval that greater skill, more extended and better cultivation, and the use of larger quantities of fertilizers have been apparent. The fact that more land has been brought under cultivation than ever before in the history of the island promises well for its future, for it must be remembered that, although Porto Rico is, for a West Indian island, thickly populated, having about 350 persons to the square mile, only 20 per cent. of the land is under crops, in spite of the fact that very little of it is wholly unsuited to the purpose.

Sugar is the leading crop, and this has of course yielded large profits. The rotation of crops on cane lands is a matter deserving more attention in Porto Rico, as the general custom is to allow such lands to return to pasture. The agricultural station urges the planting of legumes, especially velvet beans, after taking off the last crop of ratoons. This bean makes an enormous growth under Porto Rican conditions, and not only improves the soil by adding nitrogen, but also yields a large quantity of forage which is very useful in feeding the number of working cattle employed on cane estates. Moreover, the velvet bean is so easily planted that it is scarcely more expensive to grow it as a crop than to allow the land to lie fallow.

Another good practice strongly advocated by this experiment station is that of planting edible beans in the fields of young canes. One of the largest Porto Rican importations is the red bean, which, along with rice, forms the principal article of diet of the people.

Not only is the growing of this crop profitable in itself, but the practice improves the land by storing nitrogen, the element most needed by Porto Rican soils. Mr. May thinks that, since the labourer needs the beans for food, and the planter wants the nitrogen in his soil, it would be of advantage to both if the planter allowed his labourers to grow the bean wherever possible, because the resulting improvement of the soil would repay the owner, even though he gave the labourer the entire crop of beans.

The coffee industry had somewhat fallen off throughout the year. Prices have been low, and the difficulties of shipping have been great.

A movement for the formation of an association of the coffee growers seems to offer hopes of better success in the future. The association will arrange to have Porto Rican coffee roasted and packed under its own name and brand, and to sell the product by agreement with grocers who will give it a thorough trial, the growers carefully guaranteeing its quality and freshness.

In connexion with the cultivation of coffee also Mr. May urges the advantage of growing beans on the plantations. Although red beans are sold locally for as much as 18c. per lb., and are brought from countries as far away as Manchuria, the coffee growers, as well as the sugar planters, seem to think their production not worthy of attention.

The cultivation of tobacco, the third of the principal crops of Porto Rico, has increased, and the quality of the product has been much improved. New methods of cultivating the plant, and curing and fermenting the leaves have built up a reputation for Porto Rican cigars in the United States. The tobacco factory employees in Porto Rico are the best organized labourers there, and receive the highest wages.

The fruit industry has not been particularly flourishing, as the prices throughout the year have been low. The trouble is that the larger part of the fruit shipped has been poorly packed, or defective in appearance and quality. Improvement in this industry will come through organization and co-operation, especially in packing and marketing. It is most important in any fruit industry that the product should be of standard quality.

With respect to minor crops, the production of those consumed locally has shown the greatest increase. There is still room, however, for much extension in this direction. Mr. May points out that 80 per cent. of the land of Porto Rico is uncultivated, while $5,598,799 worth of rice is imported; and he believes that there are vast possibilities of growing that crop on the island. Beans and peas also, to the value of $819,703, were imported during the year, and these can be easily grown almost all over the island. The fact is that the profits accruing from the chief crops, such as sugar and tobacco, overshadow those of the minor ones; and yet some of these might possibly be the more profitable. Without diminishing its efforts to increase its export trade, Porto Rico could with great profit produce a very great portion of the foodstuffs now imported, thus guarding against the danger of food shortage.

A local manufacture, which has grown very largely in recent years, is that of weaving hats. From Mayaguez, a port on the west coast of Porto Rico, hats valued at more than $500,000 were exported during the year.

With regard to stock farming, it appears that owing to the greatly extended planting of sugar-cane there is a large demand for working oxen, and the value of these has increased greatly. To raise more live stock, however, more forage must be grown. The pasture lands of the hills produce for the most part grasses of a poor type. The experiment station has introduced, and is distributing seeds of Sudan grass, kafir corn, and other forage plants of desirable types. Here again the velvet bean is proving one of the best plants introduced as a forage producer. The native cattle in Porto Rico, which are mainly intended for working purposes, show size and vigour, but as milk producers they need much improvement. In this direction the station is giving much assistance, by assisting breeders to import cattle of good breeds, and by selling at reasonable prices animals bred in the station herd.

The *Journal of the Board of Agriculture*, May 1918, draws attention to a notice issued by the Food Production Department early in May, as to the advisability of growing maize for fodder in certain parts of England. In the southern and south-eastern counties where, comparatively speaking, the climate is mild, the rainfall low, and periods of drought are frequent, no forage crop will better repay attention at the present time than maize. Easily cultivated, it is suited to a variety of soils, and will produce a large bulk—20 tons and upwards per acre—of succulent material suitable for supplementary grass in early autumn, or, if made into silage, for replacing part of the winter root-ration. Maize is much relished by all classes of farm stock, and it is especially valuable for dairy cows, encouraging a large flow of milk.

PLANT DISEASES.

RESISTANCE AND SUSCEPTIBILITY.

The *American Journal of Botany*, June 1918, contains two papers bearing on the above subject. W. A. Orton ('Breeding for Disease Resistance in Plants') reviews some of the salient instances of success along these lines.

The common asparagus was cultivated in America up to 1896 without any notable loss from disease. Six years after that date the European asparagus rust had spread across the continent. An English variety, Reading Giant, was found to be so resistant as to escape serious damage, and from this and other similar imported types the American continent is now being restocked. It is found that where the susceptible types have been eliminated, and the reservoirs of infection thus removed, the disease can be reduced to negligible proportions.

Selection has been notably successful in the well-known cases of Fusarium wilt of cotton, and the similar disease of cowpeas; and in the more recent case of cabbage yellows, another Fusarium disease, great success has been attained, and varieties are now being propagated which will prevent the devastation experienced on infected soil. The Fusarium wilt of tomato is being dealt with on similar lines, with results that are already good in regard to a late variety, while satisfactory early varieties are in sight. Strains of flax resistant to *Fusarium lini* have made possible the continued culture of this crop in regions where it was being abandoned.

The writer discusses the addititional risks, as a result of extending commerce, of the importation of new diseases, and makes a suggestion that explorers in search of new varieties should in all cases be accompanied by pathologists to note the diseases occurring in regions from which introductions are made.

The second paper, by D. F. Jones, deals with the segregation of susceptibility to parasitism in maize, as studied in the inheritance of this character in relation to the corn smut (*Ustilago Zeae*).

Six inbred strains, derived from one original variety, and two from a different variety, and the first and second generation hybrids of these strains were studied.

In the comparison of nearly 1,000 individuals grown side by side, there was a difference in two of the strains between complete freedom and 10 per cent. of infection. The strain from which infection was absent was the most vigorous of the four inbred lines from the same parent, having a darker green colour, and being larger and more productive than the other three. The author considers it doubtful, however, that vigour in this case is more than a minor factor in resistance, since many naturally crossed varieties are several times as vigorous and productive, and yet are quite susceptib'e.

The results 'show without a doubt that segregation of susceptibility to infection by the smut fungus has taken place during the reduction to homozygosity accompanying the inbreeding process.'

A recent progress report, on the trials conducted by the British Board of Agriculture of varieties of potatoes resistant to the black scab disease, shows that numerous immune strains of considerable productiveness are now available for use in infected districts. Where cases of the apparent breakdown of immunity have occurred, they have usually been traceable to impurities in the strain. The production of these resistant and immune varieties is of high importance in connexion with the war-time production of food, as some of the principal potato-growing areas had become infected with this highly destructive and persistent disease.

W.N.

WILD TAMARIND—A PEST OR A BENEFIT?

A leaflet published by the Department of Agriculture, Ceylon, on the uses of *Leucaena glauca*, has recently been received at this Office. As will be noticed below, this plant is utilized in several ways not only in Ceylon, but in other parts of the East. In reference to the above question, we have received a communication from Mr. Joseph Jones, Curator of the Botanic Station, Dominica, in which he sounds a note of warning as to this plant for planters in the West Indies. It may also be remarked that Mr. Jones's opinion that the wild tamarind is regarded as a pest on or near to cultivated land, on account of the great difficulty in eradicating it when once established, is fully shared by planters in St. Croix, Antigua, and Barbados, all of which are among the drier islands of the West Indies. This corroborates Mr. Jones's conjecture that the characteristic of persistency, so evident in the plant in drier situations, may have been modified under damper conditions. Mr. Jones says:—

'From time to time notes appear in the publications of the Agricultural Departments in the Eastern Tropics on the uses of *Leucaena glauca*, a small leguminous tree native to Tropical America. In some of the West Indian islands this plant is known as the Horse Tamarind or Wild Tamarind. The value of its food for fuel is well known, and the leaves are eaten by cattle and goats. It is, however, regarded in some parts of the West Indies as a pest. Once established in the land it is almost impossible to eradicate it except at a very great cost of labour. No amount of cutting back will kill the plants. Only by digging out the roots, which is a most tedious operation, can the land be cleared. It comes therefore as a surprise to find that this plant is recommended for use as a soil renovator, this is, as a green dressing, in the Eastern Tropics, when so many other plants, the roots of which rapidly decay or are easily eliminated from the soil, would accomplish the same result.

'In Dominica the plant thrives in places in which the rainfall averages 80 inches annually, that is, in the drier parts of the island. It does not occur in the wet districts, and it is possible that when grown in wet places in the East as shade for coffee, the characteristic of persistency which is so dominant in the West may be modified. It may even require some care to grow it under damp conditions, and when grown it may not spread as it does in dry places in the West Indies.

'No doubt *Leucaena glauca* has its uses in dry districts as a fuel plant, and also for fodder. But under the latter conditions in the East, unless some great change has taken place in the habit of the plant, it is bound sooner or later to come to be regarded as it is in the West, that is, a pest on or near to cultivated lands.'

In the leaflet referred to above, information is given with regard to *Leucaena glauca* as a green manure, and as fuel.

For some years the plant has been used on the Experiment Station, Peradeniya, as a green manure for rubber, and has been regularly cut four or five times a year with the object of adding humus to the soil. The average quantity of green material per acre per year, has been found to be: first year after planting, 29,000 lb.; second year, 77,000 lb.; and third year, 91,900 lb. Under these conditions it is kept at an average height of 2 feet. In Java it is likewise used as a green manure plant. It is commonly employed in young coffee and rubber plantations, and has been experimented with on tea estates.

It is also used in Java as a light shade for Robusta coffee, and is being similarly employed at the Peradeniya Experiment Station, where it seems to be well suited for the purpose. As shade trees the plants are allowed to grow to about 10 feet in height, and are lopped twice a year, the loppings being used as mulch around the coffee trees.

In Mauritius, where the plant grows wild over extensive areas, it is cut regularly every year or every alternate year for fuel. The individual stems of the plants cut out for this purpose have a diameter of between 2 and 3 inches. Under Mauritian conditions, trees left for years uncut rarely attain a height of more than 15 to 18 feet. In Java the trees grow to a height of 24 feet. In Mauritius the plant is found mainly in the dry zone, and is encouraged as a light shade in fibre plantations. In the neighbouring island of Rodriguez, large tracts of land are covered with *Leucaena glauca*. Fuel is cut from these lands for local purposes, the leaves are collected for feeding cattle and goats, and the dry seed for export to Mauritius, where it is greatly appreciated as a cattle food.

Cattle are very fond of the leaves of *Leucaena glauca*, and so are goats, herds of these animals being in some places housed, and fed solely upon leaves of the plant. An analysis of the leaves shows that they are particularly rich in nitrogen and potash salts.

The seeds are also a valuable food, rich in nitrogen, and may be fed to cattle, sheep, or goats. Neither the leaves nor the seeds, however, should be fed to horses, as they cause an irritation of the skin, with subsequent loss of hair from the mane and tail.

On account of the hard seed-coat it is usual in practice, before feeding them to stock, either to boil the seeds until the seed-coats burst, or to crush the seeds dry in an ordinary seed crusher. The latter practice is generally recognized in Mauritius as being the more satisfactory.

In the Philippines, *Leucaena glauca* is used to provide shelter for seedlings in the forest plantations. The young forest trees are afforded a light shade by the *Leucaena glauca*, and when they have attained a fair size it is cut out and used as fuel. Experimental plots have yielded average returns of 10 cords of fuel per acre per year. The fuel is considered to be a high-class fuel wood, with a straight grain, splitting easily. The leaflet from which the above information is taken, considers that under average conditions in Ceylon, the first cutting of wood would be possible at the end of three years after planting.

Leucaena glauca is also reported to be a soil renovator. It is a general experience in the eastern countries where it is being grown that soil, after having been under this plant and subsequently taken into cultivation, is of good fertility, and there are instances of poor land having been improved by being allowed to remain for some years under it.

The leaflet concludes that the plant is most suited in Ceylon to semi-tropical conditions, and to those localities that do not have too high a rainfall.

THE SOURCES AND CHANNELS OF INFECTION IN HOG CHOLERA.

In a report issued by the Bureau of Animal Industry, United States Department of Agriculture, in 1889, on Hog Cholera, the sources and channels of infection were enumerated as follows:—

(1) Pigs purchased from infected herds, or coming in contact with those from infected farms, or running over grounds which had been occupied by diseased swine two or three months previously.

(2) Infected streams may communicate the disease to herds below the source of infection.

(3) Infection may be carried in feed, on implements, and on the feet and clothing of persons coming from infected herds and premises.

(4) Winds, insects, birds, and various animals may transport hog cholera virus.

This statement of the ways in which hog cholera is spread forms the basis of the present sanitary regulations with regard to this disease in the United States. In actual practice, however, one or more of these channels of infection may be of preponderating importance, and the determination of such relative importance might greatly simplify the difficult problem of sanitary control. Accordingly, Messrs. M. Dorset, C. N. McBryde, W. B. Niles, and J. H. Rietz, of the Bureau of Animal Industry, United States Department of Agriculture, have recorded in the *Journal of Agricultural Research*, April 8, 1918, a series of experiments conducted by them in investigating this question.

The authors state that although the data obtained from these experiments are not sufficient to warrant sweeping conclusions, the results are nevertheless quite suggestive, and they serve to bring out some interesting points which may be summarized as follows:—

(1) The fact that the blood, excreta, and eye and nose secretions of hogs sick of cholera contain the virus of the disease has long been well established. When injected into healthy hogs, the eye and nose secretions and fæces were found to be infectious on the third day after infection; the urine was regularly infectious by the fourth or fifth day, and the blood was infectious as early as the first day. It is to be noted that the eye and nose secretions may be infectious before there is any visible discharge from those organs.

(2) Healthy pigs were associated with cholera-infected pigs for forty-eight-hour periods on every second day from the first to the eleventh day after infection. With the exception of those exposed during the first forty-eight-hour interval, all contracted hog cholera. Other pigs exposed to cholera-infected pigs seventeen and twenty-one days after infection also contracted the disease. It is evident, therefore, that cholera-infected pigs may transmit the disease by contact at practically all stages of the disease, even before the appearance of visible symptoms, and before the animal can be recognized as sick.

(3) Healthy pigs were placed in pens with pigs which had recovered from attacks of hog cholera. Other healthy pigs were inoculated with blood from the recovered pigs. None of the pigs associated in this way with recovered pigs developed hog cholera.

(4) Healthy pigs were exposed for long periods of time to pigeons which passed daily from a heavily infected pen, only 10 feet away, containing sick and dying pigs, to the pen containing the healthy ones. None of the exposed pigs in this experiment developed cholera. While the assumption would hardly be warranted that pigeons never convey hog cholera, it does not seem likely that they are often concerned in the spread of this disease.

MARKET REPORTS.

London.—The West India Committee Circular, July 11.

Arrowroot—1/- to 1/5.
Balata—Venezuelan Block, 3/4¼ to 3/7; Sheet, 3/11 to 4/3.
Beeswax—No quotations.
Cacao—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, 175/- to 195/-.
Lime Juice—Raw, 3/3 to 4/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—5½*d.* to 6*d.*.
Rubber—Para, fine hard, 3/1¼; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., July 27.

Cacao—Venezuelan, $11·10; Trinidad, $11·75 to $12·40.
Coco-nut Oil—$1·16 per gallon.
Coffee—Venezuelan, no quotations.
Copra—$6·25 per 100 lb.
Dhal—No quotations.
Onions—$4·00 per 100 lb.
Peas, Split—$8·00 per bag.
Potatoes—English, $5·00 per 100 lb.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros. & Co., July 12.

Cacao—Caracas, 13c.; Grenada, 13c.; Trinidad, 12¾c. to 13c.; Jamaica, 11½c. to 12c.
Coco-nuts—Jamaica selects, $42·00; Trinidad $40·00; culls, $20·00 to $21·00 per M.
Coffee—Jamaica, 9½c. to 11c. per lb.
Ginger—15½c. to 16½c. per lb.
Goat Skins—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per lb.
Grape Fruit—Jamaica, importation prohibited.
Limes—Importation prohibited.
Mace—40c. to 45c. per lb.
Nutmegs—27c.
Oranges—Importation prohibited.
Pimento—6¾c. to 7c. per lb.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·055c. Molasses, 89°, 4·998c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., August 6.

Arrowroot—$12·00 per 100 lb.
Cacao—$12·50 to $13·00 per 100 lb.
Coco-nuts—$48·00 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $5·00.

Publications on sale of the Imperial Department of Agriculture.

The 'WEST INDIAN BULLETIN': A Quarterly Scientific Journal.

Volume XVII, No. 1. Containing Papers on Insects attacking Cotton Bolls, and a Paper on Fish Poisoning.

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The Pamphlets and Handbooks are written in a simple and popular manner, and the information contained in them is especially adapted to West Indian conditions. The number issued up to the present time is eighty-two.

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The 'Agricultural News' contains extracts from official correspondence, and from progress and other reports; and, in fact, any information indicating what is going on in each colony, and the progress made in agricultural matters throughout the West Indies.

The 'Agricultural News' is printed in time to be distributed regularly by each mail, and is on sale by the local agents of the Department at one penny per number, post free 1½*d.* The subscription price, including postage, is 2*s.* 2*d.* per half-year, or 3*s.* 3*d.* per annum. Volumes VIII to XVI complete, with title page and index, as issued—Price 4*s.* each—post free, 5*s.* The scale of charges for Advertisements may be obtained on application to the Agents.

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London: Messrs. Dulau & Co., 37, Soho Square, W.
West India Committee, 15, Seething Lane.
Barbados: Advocate Co. Ltd., Broad Street, Bridgetown.
Jamaica: The Educational Supply Company, 16, King Street, Kingston.
British Guiana: The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. H. G. Christie, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George.
St. Vincent: Mr. J. D. Bonadie, 'Times' Office.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau.
Montserrat: Mr. W. Robson, Botanic Station.
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 81, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

VOL. XVII. No. 427. BARBADOS, SEPTEMBER 7, 1918. PRICE 1d

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Commercial Museum at Ottawa.

TOWARDS the close of 1917 information was received from Mr. Watson Griffin, Superintendent of the Commercial Intelligence Branch of the Canadian Department of Trade and Commerce, of the intention of the Department to open a Commercial Museum in Ottawa at an early date, and that it was deemed desirable to institute a West Indian Section, more particularly devoted to West Indian raw materials that might be used in Canadian manufactures. The idea seemed admirable, and steps were taken to foster it and to encourage the co-operation of the several West Indian colonies. Some progress has already been made, and certain colonies have sent forward instalments of interesting and useful exhibits.

In the past there were recurrent efforts to send exhibits from practically all the West Indian colonies to the Canadian National Exhibition held annually at Toronto. While, doubtless, these efforts were useful and served to draw considerable attention on the part of Canadian and American visitors to the West Indies, their products, and their potentialities, still these Exhibitions were fleeting in character, and the exhibits had to be renewed annually, at considerable expenditure of energy and trouble.

There will be particular advantage in having a permanent Exhibition, for this will be available for steady and constant reference on the part of business men who desire to obtain information concerning the products of the West Indies. The knowledge which will be thus available will be supplemented by abundant references to the business aspects of the case and to the literature of the matters under consideration, and this in a degree and to an extent that was impossible in the case of a temporary Exhibition, however interesting. Once established and possessing adequate exhibits and concomitant information of a commercial, agricultural, and scientific character, this Museum will be consulted by those interested in the various products; and doubtless information will be sought, not only by dwellers in Canada, but also by those in the West Indies or other countries capable of producing raw material of interest, and so the Museum, with its catalogues, libraries and general forms of information will be employed both by the users and the producers

of materials as a means of acquiring and exchanging knowledge in a manner which cannot fail to be of service to established industries, but will also be invaluable in building up new ones. Such a Museum with its concomitant means of affording and obtaining information appears to be essential to the further development of commercial relations between the West Indies and Canada.

A feature arising out of its permanence which will appeal to all those who have taken part in preparing exhibits for the Canadian National Exhibitions already referred to, is that exhibits for the Museum can be collected at leisure; there is no time limit, such as often worried intending exhibitors in other cases, where exhibits must be sent by a particular steamer and ran the risk of being useless if they failed to arrive in time. Furthermore, it is unnecessary to send the exhibits prepared in a form for immediate display; the Museum authorities will prepare them in the most appropriate manner. All that the senders are concerned with is that the specimens sent shall be typical of the product in question, and that the quantity shall be such as will enable proper display to be made.

Reference to the literature of the several West Indian colonies, and particularly to the handbooks which were annually produced by the Imperial Department of Agriculture to accompany the exhibits sent to the Toronto Exhibition, goes to show that there are abundant materials to be sent from each colony to form instructive exhibits, which could serve, not merely for amusement or transient instruction, but for aiding in the building up of a sound body of commercial and agricultural knowledge, which will reflect itself in further development of existing industries, the creation of new ones, and a marked expansion of the trade between Canada and these islands.

Not only those who in the course of their connexion with Exhibition Committees, Agricultural Departments, and other administrative bodies who have to do with exhibition matters, but also planters and merchants interested in the development of the trade and resources of their respective colonies will be well advised to inform themselves concerning this Museum, and the part that is being taken locally to ensure the adequate representation of the colony in which each is interested. The matter is one of real importance, and one in which individual interest will go far to secure success.

The following outline in tabular form of the exports from the West Indies and British Guiana will afford some idea of the materials existing in each colony to form the basis of a permanent exhibit in the Museum, and the hope may be expressed that at no distant date the Museum will be adequately furnished with exhibits doing justice to each colony.

Colony.	Principal Articles of Export.
British Guiana ...	Sugar, gold, diamonds, balata, rice, timber, charcoal, lumber, coco-nuts, coffee.
Trinidad and Tobago...	Sugar, molasses, cacao, asphalt, coco-nuts, copra, hides.
Grenada	Cacao (raw), coco-nuts, spices (nutmegs, mace).
St. Lucia	Cacao, coco-nuts, limes and lime juice, hides, sugar (muscovado, vacuum pan), mace, nutmegs, honey, bay leaves, bay oil.
St. Vincent... ...	Cotton, arrowroot, cacao, molasses, sugar (crystallized, muscovado), syrup, ground nuts, cassava starch.
Barbados	Molasses, syrup, sugar, cotton, hides and skins, rum, vegetables (fresh).
Antigua	Sugar (crystals, muscovado), syrup, molasses, cotton, tamarinds in syrup, onions, limes and lime juice, hides and skins.
St. Kitts-Nevis ...	Sugar (muscovado, vacuum pan), molasses, cotton, lime juice, vegetables, coco-nuts.
Dominica	Limes (fresh and pickled), oranges, other fruit and vegetables, raw and concentrated lime juice, lime juice cordial, citrate of lime, cacao, coco-nuts, bay leaves, bay oil, orange oil, jams and jellies, hides, honey.
Montserrat	Cotton, sugar (muscovado), papain, fresh fruit, bay oil and bay leaves.
Jamaica	Sugar, rum, tobacco (including cigars), bananas, oranges, orange oil. coffee, ginger, pimento, dyewoods, cacao, hides and skins.
Bahamas	Sponges, sisal canned pineapples, turtle shell, bêche-de-mer.
British Honduras ...	Mahogany and other wood, dye-woods, cohune nuts.

As stated above, exhibits have already been forwarded from several of the colonies, and it is understood that others are in preparation; these exhibits can be forwarded as they accumulate, and it is hoped that they will now go forward in a steady stream, until the resources of each colony are adequately made apparent. It is gratifying to be able to record that the Royal Mail Steam Packet Company has signified its willingness to convey, free of cost, exhibits intended for this Museum and forwarded through duly recognized channels.

In addition to exhibits of raw materials it will add greatly to the attractiveness of the Museum's galleries, and to the instructiveness of the exhibits, if good displays of photographs and other forms of illustration can be included. These may show the manner in which the various commodities are grown or prepared for export, and also the nature of the country in which they are produced. Anything which tends accurately to inform those with whom business relations are to be established and maintained is calculated to facilitate the exchange of ideas, and to put matters on a sounder footing. Photographs, illustrations, models, and similar objects are desirable, and should be acquired for the Museum, whenever possible.

It is quite probable that arrangements may also be made in connexion with this Museum, as has been done at the Imperial Institute, to inaugurate series of lectures for the information of commercial men, explanatory of the products and industries of the several countries represented. It is quite possible too, that some similar use may be made of this institution for educational purposes in connexion with Universities and Colleges.

Mention should also be made of the similar permanent exhibition in the Colonial Galleries of the Imperial Institute in London. The foregoing remarks apply equally to this: it is felt that the best interests of these colonies will be served by ensuring that these exhibits in London are maintained in a proper condition to illustrate with reasonable accuracy the resources of these colonies.

THE PLACE OF GEOGRAPHY IN EDUCATION.

The *Geographical Journal*, July 1918, publishes the address delivered at the Anniversary General Meeting of the Royal Geographical Society, held on May 27, 1918, by the President, Colonel Sir Thomas Holdich. In the course of this address, the President made the following interesting remarks concerning a more general recognition of the claims of geography in the field of education than has hitherto been accorded to it. He said: 'We, as you know, have taken an active interest in advocating a more general recognition of the claims of geography in the field of education than has hitherto been accorded to it. The opportunity at present before us of pressing these claims is perhaps exceptional. All the world which gets its political and war news from the pages of the daily papers must by this time have learned the value of such education in map-reading, as may enable them to understand the topography of the countries which are the theatre of military operations, and to appreciate, to some extent at least, the advantages of position on either side to which the belligerents may attain. Geography must take its due place with other natural sciences in the school curriculum, and here, no doubt, we touch on he chief difficulty which besets the subject. The time is limited which can be devoted to education, and it must be matter for most earnest consideration with our education authorities to partition it fairly amongst the many subjects which make up general instruction. But unnecessarily short rations in geography have certainly hitherto been dealt out in schools, and schools have influenced examinations, and the examiners have been hard to convince of the necessity of more liberal distribution. At present the matter can only be described as being in a state of flux. That is to say, that it is under consideration by the constituted educational authorities; but we can truly say that it is a sympathetic consideration which is being accorded to it, and we may fairly hope for good results. A great impetus to geographical study of the higher class will be given by the example of the Universities of Oxford and Cambridge, if they decree, as is now proposed, in both universities, that geography shall be included in the subjects for a degree in honours; and I trust that those of our Fellows who are members of Convocation or of the Senate, will exert their influence in the universities on behalf of the science for whose advancement this Society was founded. If England is to hold her own in the future markets of the world, the study of commercial geography must be inculcated to an extent that is quite unrecognized at present in this country, although it is apparently well enough understood elsewhere. It is indeed astonishing how little the subject of commercial geography attracts students, for it cannot fail to be of the greatest practical importance in a commercial career. One reason may be that the great majority of students are not seeking a commercial career. Another may be the peculiarly technical character of the subject, as well as its infinite capacity for change in its objective from year to year—even from month to month. Clearly it demands special schools and specialized instruction. It should not be neglected or ignored, for it may be doubted whether practically it is not as important a branch of geographical teaching as that which touches political or military issues. In this connexion I trust that all the accumulated information of the War Trades Intelligence Department may be made available for public use when the war is over.'

DEPARTMENT NEWS.

Mr. W. Nowell, D.I.C., Mycologist on the staff of the Imperial Department of Agriculture has left Barbados for Dominica with the object of investigating certain points which have arisen in connexion with root diseases. Mr. Nowell will afterwards proceed to Montserrat to continue the study of cotton boll diseases. He is expected to return to Barbados about the middle of October.

SUGAR INDUSTRY.

REVIEW OF THE WORK OF TWO WEST INDIAN SUGAR FACTORIES, 1918.

At the instance of the Directors of Gunthorpe's Factory, Antigua and Basseterre Factory, St. Kitts, the results of the working of these factories for the past season have been furnished to the Imperial Commissioner of Agriculture for the West Indies. The following information based on these reports is not without interest and value to those concerned with the manufacture of sugar in the West Indies.

The Antigua factory manufactured 7,316 tons of sugar from 64,282 tons of canes; the St. Kitts factory 7,314 tons of sugar from 62,355 tons of canes.

The work of these factories is about up to the standard reached in the last season, St. Kitts again leading slightly, as on the previous occasion.

The main features of the factories' work may be gathered from Table I.

Table II shows the recovery and losses of sucrose. The average composition of the cane dealt with, calculated from the data supplied, is given in Table III.

TABLE I.

	1918. Antigua.	St. Kitts.
Cane crushed, tons	64,282	62,355
Juice diluted, tons	62,462	57,274
Juice undiluted, tons	47,905	46,437
Juice expressed per 100 cane	74·5	74·5
Juice expressed per 100 parts of juice in cane. Or sucrose extracted per 100 parts of sucrose in cane	93·85	93·69
Sucrose in juice, tons	7,901	7,606
Commercial sugar made, tons	7,316	7,314
Purity diluted juice	83·7	86·2
Sucrose in 100 cane	13·10	13 02
Fibre in 100 cane	16·05	16·03
Sucrose in 100 megass	2·45	2·50
Juice in megass per 100 fibre	30·6	31 3
Juice lost per 100 cane	4·9	5·0
Recovery commercial sugar per 100 sucrose in juice	92·6	99·17
Recovery sucrose per 100 sucrose in juice	89·1	92·4
Commercial sugar made per 100 sucrose in cane	86·9	90·1
Calculated to 96° sugar	87·1	90·2
Sucrose in above per 100 sucrose in cane	83·6	86·6
Tons cane per ton commercial sugar	8·78	8·53
Polarization sugar made	96·17	96·07
Molasses, Imperial gallons	332,239	276,910
Molasses per ton of sugar	45·4	37·9
Filter cake, tons	1,038	831
Sucrose per 100 filter cake	4·25	4·87

TABLE II.

Per 100 parts of Cane.	Antigua.	St. Kitts.
Sucrose recovered in sugar	10·95	11 27
Sucrose lost in megass	·81	·82
Sucrose lost in press' cake	·07	·06
Sucrose lost in molasses	1·14	} —
Unrecorded loss	·13	} 1·87
	13·10	13·02
Per 100 parts of Sucrose in Cane.		
Sucrose recovered in sugar	83·56	86·55
Sucrose lost in megass	6·15	6·31
Sucrose lost in press cake	·52	·46
Sucrose lost in molasses	8·72	} —
Unrecorded loss	1·05	} 6·68
	100·00	100·00

TABLE III.

Composition of Cane.		
Sucrose	13·10	13·02
Glucose	1·04	·79
Non-sugars	1·51	1·29
Fibre	16·05	16·03
Water	68·30	68·87
	100·00	100·00

The character of the work done may best be appreciated by comparison with that in the best factories in other countries. The principal factor in determining the work of a sugar factory is the efficiency of the mills. Gunthorpe's mills in the season under review extracted 93·85 per cent. of the sucrose in the cane, and Basseterre 93·69, while the average work of the mills in Java for the crop of 1917 is represented by an extraction of 88·9.

One point not to be overlooked is this: that the extraction of sucrose from the cane is influenced by the amount of fibre that the cane contains. In Java the amount of fibre in the cane averaged 13·10 per cent.; in Antigua and St. Kitts the averages were, respectively, 16·05 and 16·03, showing these mills to be at a disadvantage in this respect.

The recovery of sucrose from the sucrose in the juice, that is to say, the work of the factories subsequent to the mills, was good at St. Kitts, being 92·4 per cent., it was somewhat less efficient at Antigua, where it was 89·1 per cent.

The recovery in the form of sucrose in the sugar sold was at Antigua, 83·6 per cent., at St. Kitts, 86·6, the Antigua factory producing a larger proportion of molasses.

The foregoing review of the work of the past season shows that the character of the work at Antigua and St. Kitts, and the high level of efficiency reached, concerning which comparisons were made last year in this Journal (Vol. XVI, p. 356) have been well maintained.

At the present time the greater part of the cohune oil extracted in the tropics is consumed locally by the natives for culinary purposes. A considerable tonnage of the kernels is shipped to the United States for extraction of the oil. Probably 80 per cent. of these kernels are extracted by the natives, who break the nuts between two stones after removing the outer husks. (The *Perfumery and Essential Oil Record*, July 23, 1918.)

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and seventy-fourth meeting of the Council of the British Cotton Growing Association was held at the Offices of the Association, 15, Cross Street, Manchester, on Tuesday, August 6, 1918.

In the absence of the President (The Right Hon. the Earl of Derby, K.G.,) Mr. Alfred Crewdson occupied the Chair.

WEST AFRICA. The whole of the long stapled American cotton crop grown in the Zaria District, under the auspices of the Government Agricultural Department, has now been marketed, and the actual returns in bales of 400 lb. each for the past five years are as follows:—

Year	1918	1917	1916	1915	1914
Bales	855	433	121	24	11

These figures show that substantial progress is being made, but the returns for the past season would have shown even greater improvement had it not been for the unfavourable climatic conditions. Some of this cotton has recently been received in Liverpool, and has realized good prices. It was pointed out that this type of cotton exactly meets the requirements of the Lancashire spinners, and it is intended to develop its cultivation as rapidly as possible. There has been a satisfactory demand for seed for next season's crop, and practically all the long staple cotton seed has been distributed in approved areas, in addition to large quantities of the native variety in other districts.

The purchases of cotton in Lagos to July 31, amounted to 2,492 bales, as compared with 7,649 bales for the same period of last year, 8,993 bales for 1916, and 5,108 bales for 1915.

The purchases in Northern Nigeria to June 30, amounted to 2,316 bales as compared with 3,652 bales for the same period of last year, 10,386 bales for 1916, and 411 bales for 1915.

UGANDA. The 1917-18 cotton crop was very disappointing, and only amounted to about 13,000 bales. Practically the whole of the 1916-17 crop has now been shipped, and the position is more satisfactory than appeared likely some months ago.

Owing to the lack of freight, and heavy insurance charges, larger quantities of Uganda cotton are being shipped to India than previously, and the returns for the quarter ending March 31 last show that 210,000 lb. weight of cotton, valued at £17,500, was exported to the United Kingdom, and 1,251,633 lb. weight, valued at £104,303, to India and Burma. Under present conditions India is in a much more favourable position than this country as regards shipping facilities and insurance charges from East Africa.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Plant distribution during the month of July comprised: limes, 2,800; budded oranges, 70; budded grape fruit, 64; grafted mangoes, 46; ornamental, 60; various, 2; cuttings, 6; seed coco-nuts, 496; *Cassum copticum* seed, ½ lb.; other seeds, 2 packages. Mr. J. C. Moore, the Superintendent of Agriculture, referring to staple crops, states that cacao is still blossoming, and the crop promises fair: lime trees were fruiting well, and crushing had begun. There has been no noticeable extension of the area under canes: some land has been prepared for fall planting. There is a good crop of nutmegs, with very high prices, inducing speculation by shippers. Sea Island and Marie Galante cotton is being planted on some estates: at present about 200 acres are sown. Thrips on cacao is reported prevalent in some localities. Spraying with Nicotine-Bordeaux mixture is in progress on several estates, and the Agricultural Department is assisting in various ways to combat the outbreak. The present Prize-Holdings Competition is said to be the largest on record, there being over 700 entries. The weather in July was fair: several nights were gusty. Some planters complain of absence of needed showers. The rainfall registered at Richmond Hill was 10·57 inches.

ST. LUCIA. During the month of July the following plants were distributed: limes, 3,977; ornamental and decorative, 36; vegetable seeds, 46, packets; *Chrysalidocarpus lutescens*, 2 lb. 10 oz. In regard to staple crops, the Agricultural Superintendent, Mr. A. J. Brooks, states that cacao was setting, limes were good, and good growth was being made in the cane fields; there was a steady extension of lime cultivation. Special attention was given during the month to the eradication of love vine in the Castries district. The Lime Factory was working at full pressure. A self-feeding carrier—an improvement on the one working at Carenage, Trinidad,—has been devised and erected at the factory. This carrier keeps the mill fed without attention. Instruction in connexion with the Cacao and Lime Prize-Holdings scheme was continued throughout the month: good work is being done. The rainfall recorded at the Botanic Gardens, Castries, during the month was 6·07 inches; at the Agricultural and Botanic Station, Choiseul, the record was 8·25 inches.

ST. VINCENT. The Agricultural Superintendent, Mr. W. N. Sands, writes to say that the ginning of the 1917-18 cotton crop was completed in July. The yield of Sea Island cotton lint was equal to 914 bales of 360 lb. each, or an increase of 105 per cent. on the output of 1916-17. The Marie Galante cotton equalled 106 bales of 360 lb. each, so that the total crop of cotton for the Colony was 1,020 bales. Cotton planting was continued during the month. At the Experiment Station 14,368 cotton stainers were collected as the result of an invasion on July 18. The weather during the month was excellent—showery. The rainfall recorded at the Botanic Station amounted to 11·08 inches; at the Experiment Station the precipitation was 7·44 inches. Plant distribution included 100 lb. of selected Indian corn.

Accompanying the foregoing is a record of special work of officers for the month of July, in connexion with the control of bush bugs and the cotton stainer.

VIRGIN ISLANDS. Shortage of labour caused serious inconvenience in carrying on the work of the Tortola Experiment Station during the month of July. Plant distribution consisted of 133 lb. of cotton seed only. Mr. W. C. Fishlock, the Curator, says that rain is needed for the newly planted cotton; otherwise, the condition of the peasant cultivations is fairly good. There is a considerable revival of interest in cotton, and reports agree that a much larger area has been planted than for some years past. There is also a gratifying display of interest in the planting of food crops. Worm-eaten cotton was observed at Virgin Gorda, but the damage appeared to have been done by grass worms, and not by the true cotton worm, which usually makes its appearance late in the year. The weather during the month was dry. Though rain fell in measurable quantity on eighteen days, the total precipitation was but 2·14 inches, as compared with an average of 4·16 inches for the previous seventeen years.

HOME DRYING OF FRUITS AND VEGETABLES.

Farmers' Bulletin 984, United States Department of Agriculture, is devoted to the subject of farm and home drying of fruits and vegetables. In the introductory remarks it is pointed out that, at the present time, imperative necessity demands nation-wide conservation of those portions of our food crops which have heretofore been permitted to go to waste. As is well known, a considerable portion of this wasted food material is made up of perishable fruits and vegetables produced in home gardens and fruit plots in excess of the immediate needs of the producers, and in the absence of accessible markets for the purpose.

Drying offers a simple, convenient, and economical method for preserving food materials, and permits the carrying over of the surplus into periods in which fresh fruits and vegetables are expensive or unobtainable.

Success in drying depends upon the observance of a few fundamental principles, and the quality of the product depends upon the care employed in the selection of the raw material, upon proper preparation for drying, and upon careful control of the temperatures employed, rather than upon the particular type of evaporating apparatus employed.

As a general principle, it may be stated that, in districts which normally have a rainless period coinciding with the ripening period for fruits and berries, these crops may be successfully dried in the sun or by means of glass covered solar driers. In regions which do not have such favourable climatic conditions, driers employing artificial heat must be used. In this bulletin a number of driers are described, and directions for their construction given. The smaller sizes are adapted to the needs of the individual home, and are designed to care for the surplus of garden products and fruits from the home grounds. The larger types are suited to the needs of individuals or communities having a considerable surplus of perishable crops. All the driers described are said to have been thoroughly tested in practice, and are such as may be constructed at very moderate expense from materials everywhere available by any one who can use ordinary tools.

Directions for the preparation, drying, and subsequent storage and care of the dried products are given for each of the more important fruits and vegetables. For ordinary family needs, a considerable number of small driers both patented and unpatented are mentioned, which are intended to be operative over the ordinary cook stove, and in connexion with the usual routine of the kitchen. In plan, these range from single trays, or open racks supporting several trays to be suspended from the ceiling, to strongly built all-metal cabinets with a capacity of 1 to 2 bushels at a single charge. In many cases the housewife will find it possible to do without special apparatus, and to dry such materials as she wishes to preserve in the oven of the cook stove, the products to be dried being spread thinly in baking pans or pie tins, which should be placed upon racks so that they do not come into direct contact with the oven wall. The door of the oven should be left open, so that the water vapour driven off may pass out, and the fire should be so regulated that the material may not be scorched.

Such a device as the last mentioned, would appear to be specially suited to conditions in the West Indies, where with the use of an ordinary evaporator, placed on the stove, sweet potatoes, tomatoes, and other vegetables grown in these colonies may be preserved in the manner described

SWEET POTATOES.

Sweet potatoes intended for drying may be prepared in the general manner outlined for root vegetables in so far as washing and paring are concerned. They may be cut into slices, like potatoes or carrots, or split lengthwise into quarters or eighths according to size, and dried in that form. If sliced, six or eight minutes is sufficient for blanching; if cut into quarters, the time should be increased to ten minutes, as the potatoes must be partially cooked. The temperature of the drier may be 145° to 150° F. at the beginning of the drying, and raised 10 or 15 degrees after the product loses most of its moisture. Sweet potatoes should remain in the drier until the pieces have become quite brittle, and break readily under pressure.

In humid districts in which the storage period for sweet potatoes is comparatively short, an evaporator may advantageously be used for partially drying or curing potatoes to increase their keeping period. The potatoes are brought from the field or market, spread upon the trays one or two deep, and placed in the drier, which is kept at a temperature of 90° to 100° F. by slow, careful firing. After forty-eight to seventy-two hours of this treatment, the potatoes will have lost 10 to 15 per cent. of their weight, and will have become slightly shrivelled superficially. All cuts or broken surfaces will have dried out. The potatoes should then be removed and stored in bins or cellars in the usual way. The ordinary fungi which cause rotting in storage do not attack potatoes which have been subjected to this treatment, while the cooking qualities and flavour of the potatoes are entirely unaffected by it.

TOMATOES.

Fruit intended for drying should be well ripened but still firm. Wash the tomatoes, place them in a wire basket, and submerge in boiling water for one or two minutes, to loosen the skins. Remove and allow to cool, strip off the skins, remove the hard, woody central core and any adhering skin or diseased areas, and cut the fruit into slices $\frac{3}{8}$- to $\frac{1}{2}$-inch in thickness. Spread the slices in a single layer upon the trays. Tomatoes cannot be placed directly upon naked wire trays, as the acids of the fruit become so concentrated during drying that the metal is rather vigorously attacked. Trays may be protected by painting them over with a brush dipped in boiling paraffin, or by laying pieces of cheese-cloth over them.

The temperature at the beginning should not be more than 120°F., and may be gradually increased to a maximum of 140°F., towards the completion of the drying.

Properly dried tomatoes, as taken from the drier, will show no moisture on being pressed between the fingers, and the slices will break crisply on bending. Like all other vegetable products they will become somewhat flexible and elastic after being shovelled over for some days in the curing room.

OKRAS.

The younger pods of okra may be dried entire after being steamed or blanched in boiling water for two to three minutes, while older pods should be split into halves, or if quite large, into quarters, and blanched for two minutes. Spread thinly on trays so that the pods do not overlap. Begin the drying at a temperature of 115°F. to 120°F., and gradually increase to not more than 135° as the drying proceeds.

BEANS AND PEAS.

Garden peas intended for drying should be gathered when in ideal condition for immediate table use, that is,

have begun to turn yellow and dry up. Shell them by placing the pods in boiling water for five minutes, then spread them on a wire screen, having a mesh large enough to permit the shelled peas to pass through, with a box or basket placed beneath it. Rub the pods vigorously over the screen with the hands, which will burst and empty practically all the pods much more quickly than they could be shelled by hand. The shelled peas are then given a very short dip, one to two minutes, in boiling water, drained, spread to a depth of ¾-inch to 1 inch on the trays, and dried at 115° to 120°F. as initial temperature, rising to 140° toward the completion of the drying. Stir occasionally while drying. Properly dried peas will be uniformly dry throughout, showing no moisture near the centre when split open.

String beans, not yet full-grown but sufficiently developed for table use are strung, broken into pieces, each containing not more than two beans, and dipped into vigorously boiling water for five minutes if very young, for seven to eight minutes if older or nearly grown, in water which has had two tablespoonfuls of ordinary baking soda to each gallon added to it. This will preserve the bright-green colour of the pods quite perfectly. Then spread the beans about 1 inch deep on trays, and begin drying at 130° F. Stir occasionally, and increase the temperature very gradually to 140° or 145°. The drying is complete when no moisture can be expressed from freshly broken pieces. Beans and peas which have been allowed to dry on the vines may advantageously be given a short treatment in the drier. Shell and spread them to a depth of ½- to ¾-inch in the trays, and place in the drier for ten to fifteen minutes at 165° to 180° F. This treatment will destroy insects' eggs and bean weevils, thus reducing the possibilities of loss in storage; but it also destroys the vitality of the material treated, which consequently can not be used for seed.

TREATMENT OF PRODUCTS AFTER DRYING.

After removal from the driers fruits or vegetables must be subjected to an after-curing or conditioning process before they are permanently stored away. Any lot of material, even that removed from a single tray, will not be uniformly dry throughout, some portions being over-dry, while others contain too much moisture for safety. If such material while still warm be piled loosely upon a clean floor, and subsequently thoroughly stirred at daily intervals for ten days or two weeks, the wetter portions give up some of the water to the drier parts or to the atmosphere, the moisture content of the entire mass becomes uniform, and a condition of equilibrium with the surrounding air, such that the material neither absorbs nor gives off measurable quantities of moisture, is presently attained. Material so treated is said to have been 'conditioned', and may be stored without danger of spoilage; without such treatment, the spores of fungi and bacteria present upon the material will be able to begin growth upon the wetter portions, ultimately destroying the whole. The curing room should be conveniently located with reference to the drier, should have over all the windows blinds or shutters which effectively exclude sunlight or strong daylight, and should be closely screened to exclude insects. Containers in which such products are stored should, of course, be air-tight.

Observations on the occurrence of infertile spots under tamarind trees and bamboo clumps indicate that, while numerous factors were perhaps involved, the infertility in these particular cases was due mainly to the accumulation of soluble salts accelerated by the great transpiring power of the plants, which removed soil moisture, leaving behind the greater part of the soluble salts. (*Experiment Station Record*, Vol. XXXVIII.)

THE USE OF LEAD FOR STIMULATING GROWTH IN PLANTS.

Experiments carried out in 1914 and 1915 on the action of aqueous solutions of lead nitrate showed that plants grew vigorously when treated with small quantities of lead. The maximum growth was obtained with 0·5 gram of nitrate per litre of nutritive solution. Not only did larger quantities affect the development of the roots, but they also retarded that of the leaves. The same results were obtained in this respect with all the experimental plants—rye, wheat, oats, barley, maize, and peas. The difficulty of spreading the lead nitrate was overcome by making it into a fine powder, and mixing it well with the potash salt or sodium nitrate used as a manure. Manuring experiments with beets resulted in a certain increase in yield of both roots and sugar, which could be attributed to the lead nitrate. Potatoes, on the other hand, proved very sensitive to the action of lead which caused a decreased yield of tubers and starch.

In experiments with wheat in sandy loam, the addition of 44 lb. of nitric nitrogen to the basic manure increased the grain yield by 880 lb.; 56 per cent. of this nitrogen was assimilated. The addition of 9 lb. of lead nitrate only increased the grain yield by 187 lb. as compared with the basic manure, and only 21·5 per cent. of the nitrogen was assimilated. The addition of 66 lb. of nitric nitrogen to the basic manure increased the grain yield by 1,320 lb., and 82·3 per cent. of the nitrogen was assimilated. In this case, the addition of 9 lb. of lead nitrate had a favourable effect on the grain yield, which it increased by 2,123 lb. as compared with the basic manure.

There is nothing against the practical use of lead nitrate and so long as the manufacturer can guarantee a uniform distribution of the lead, the mixing of lead nitrate with potash salts in sodium nitrate on a commercial basis is recommended. (*Experiment Station Record*, Vol. XXXVIII.)

JACK SPANIARDS.

The Curator, Montserrat, in a letter to the Imperial Commissioner, states that the Jack Spaniards, (*Polistes annularis*) introduced into Montserrat from St. Vincent, in 1910, had for several years been plentiful at Blake's Estate where they were first established.

Recent reports were to the effect that these insects were spreading to adjoining estates to a distance of 4 miles to the south-east, and to an equal distance to the north-west. This has been confirmed by a personal visit on the part of the Curator with regard to the spread to the south-east, but in the opposite direction careful search failed to confirm the report.

Attempts made in 1914 to re distribute the Jack Spaniard to other parts of the island from Blake's were not successful. The establishment of this insect, and its spread in Montserrat is of considerable interest, since it has proved to be of value in keeping the cotton worm in check.

In the *Agricultural News* for September 11, 1915, (Vol. XIV, p. 298), an article on West Indian Wasps appeared, in which the importation of Jack Spaniards into Montserrat is mentioned, and an account is there given of a 'disease' of the native wasps (*P. crinitus*), which may be responsible for the failure of *Polistes annularis* to establish itself in certain districts in Montserrat, although this matter has not been investigated fully.

H.A.B.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

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Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

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*Seconded for Military Service.
†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number deals with the opening of a Commercial Museum in Ottawa by the Canadian Department of Trade and Commerce, in which a West Indian section has been instituted.

Insect Notes, on page 282, reviews the section on Insect Pests contained in the Annual Report of the Agricultural Department of St. Lucia, recently issued.

Information obtained so far in the investigation of coco-nut diseases in Jamaica forms the subject of Plant Diseases, on page 286.

On page 276 there is a review of two sugar factories in the Leeward Islands for the season just ended, which will be found interesting and valuable for its statistical comparisons

Utilization of Waste Tomato Seeds and Skins.

A review of work already done in foreign countries on the utilization of tomato waste, an investigation of the annual output of tomato refuse in the United States, a comparison of methods of separating the ingredients of the waste, and chemical analyses and value of the most important ingredients, are included in the *United States Department of Agriculture, Bulletin 632.* It is estimated that the annual dry waste from the tomato industries in the United States is about 1,500 tons of seeds, and 1,800 tons of skins. From the seeds can be extracted an oil averaging by the continuous extraction process 22 per cent. of the dry seeds.

The refined oil is similar in constituents to cotton seed, soy bean, sesame, and corn oils. Digestibility experiments by the Office of Home Economics show a coefficient of digestibility of 97, comparing favourably with the common edible oils. It possesses a certain value as a paint or varnish oil, and makes a soap of good texture. The residue after extraction of the oil compares favourably with other seed meals used for stock feed, analysis showing moisture, 7·15; ash, 4·64; protein, 37; nitrogen-free extract, 29·1; and fibre, 22·11 per cent. By incorporating the dried skins with the meal, the annual amount available as feed stuff would be about 3,000 tons.

The author of the bulletin suggests that the reduction of waste material to oil and meal could best be handled by establishing a reducing plant at some central point in each of the sections in which the accumulation of tomato residue principally occurs. In view of the threatened shortage of fatty oils, it is suggested as an economic measure of both agricultural and industrial importance, that the utilization of this material be considered.

Thick Versus Thin Canes for Planting.

In Volume XVI of the *International Sugar Journal* (1914, p. 561), and under the above title, the author, Mr. Arthur H. Rosenfeld, ex-Director of the Agricultural Experiment Station, Tucuman, Argentina, published the results of a series of experiments made in Tucuman Experiment Station during the years 1911 and 1912, to determine whether the fact that a cane was thin indicated hereditary tendency to that type of growth or degeneration, or was simply the physical result of its location on the inside of a stool, for instance, or of unfavourable conditions of growth during the year. The results of the first experiments—consisting of crops of plant canes and of first year stubble (or ratoons) from the same planting—indicated practically no difference in the yields or analyses of the cane from the thin canes and the normal-sized canes, there being, in fact, a slight difference in yield, in favour of the cane from the thin parents, but a difference so small that it may easily be attributed to be within the limits of experimental errors.

A second series of experiments, having the same object in view, was undertaken and carried out during the years 1912-13 to 1915-16. The results of these

are briefly summarized in the volume of the journal above mentioned for July 1918, as follows:—

'The results of the second series of experiments confirm those of the first, and lead us to the inevitable conclusion that provided the stalks planted are healthy, the thickness of the cane used for plants is of little importance. It is evident that the size of the stalk does not indicate the hereditary potentialities it may possess, and we may therefore, safely assume that a rigorous selection from the point of view of healthy condition and freedom from insect attacks and disease is much more likely to give practical results in the field than a selection based on the diameter of the canes. This is brought plainly to view in the table, where we see that the average weight of stalk from the two classes of cane is almost identical, as well as the average yields of cane and the chemical analyses of the juices. Too much care, therefore, cannot be given by sugar-cane planters in selecting for health rather than for size.'

The Value of Forests in Modern Warfare.

The important part that forests are playing in the present war, is thus referred to in a paper by C. S. Judd, published in the *Hawaiian Forester and Agriculturist*, for May 1918: In this age of coal and iron, wood and other forest products, which have almost innumerable uses in modern warfare, are being sought more eagerly, and used more extensively than ever before. In the trenches, on the road, in the air, in the shipyard, in the munition factory and chemical laboratory, and in the building of cantonments, wood has become a dominant factor, and never before has the demand for exact knowledge on the quality and uses of wood been so urgent.

In modern warfare forest products are needed in large quantities. The average trench requires alone about 1 cubic foot of wood to 10 feet of trench, or about 60,000 board feet to the mile, or 15 million feet to the French front, exclusive of that required for shelter, artillery screens, block houses, and fuel.

Forest industries which were on the decline or entirely abandoned have been revived by the war, and new uses for wood products developed.

Wooden ships and airplanes call for special materials. Sitka spruce, once a despised material, is now found almost indispensable for airplane construction, furnishing long, clear, light, yet strong material, in which failure is far less common than in the metal parts. In fact, the demand for spruce wood is now so great that a spruce-production division of the Signal Corps has been formed of 10,000 men to get this needed commodity from the woods to the airplane factories.

About 200 board feet of wood is used in the actual construction of the average airplane. To obtain this material it is ordinarily necessary to work over about 1,500 feet of select lumber, which often represents all that can be used for airplanes of 15,000 board feet of standing timber.

Farming in South Africa.

The Annual Report of the Transvaal Land Owners' Association provides as usual, says The *Field*, an instructive and well-balanced survey of the development of the farming industry not only in the Transvaal but throughout the South African Union. A feature of the last year or two has been the rapid growth of the meat export trade. In 1914, 700 quarters were exported; in 1915, 33,000 quarters; in 1916, 117,000 quarters; and in the first ten months of the last year 308,000 quarters. The demand for land has improved, and this is attributed largely to the prosperity resulting from the high prices ruling for live stock and farm produce generally. The tendency throughout the Union appears to be for farmers in the southern occupied districts to sell their holdings at comparatively high prices in order to migrate northwards to the sparsely occupied districts, where at present land has appreciated in value only to a small extent. Other branches of farming besides the live stock industry are showing abundant signs of vigorous life. As the Chairman of the Transvaal Land Owners' Association said at the annual meeting at Johannesburg on May 6: 'The war in matters agricultural has provided alike an opportunity and a stimulus, and whether the Empire's necessity or self-interest has acted as the spur, it is gratifying to find that advantage is being taken of that opportunity in an ever-increasing degree. In all directions one sees neglected or unconsidered industries growing up.'

Research in Wheat Growing.

On June 27, according to *The Times*, Mr. Prothero, M.P., Minister of Agriculture, addressing a meeting of the Incorporated National Association of British and Irish Millers, amongst other things said:

'The Board of Agriculture appeals to millers to support a national institute for agricultural botany on the commercial side, working with the Plant-Breeding Institute. As soon as we get a useful variety of cereals established we want to be able to hand it over to the commercial side, who will bring it out on commercial lines, acting through the seed agents. At present it takes years and years to get a new variety of wheat or other cereal in the market, and our proposed institute is vastly to accelerate this process.

'Sir Daniel Hall, Secretary of the Board of Agriculture, said that the Plant-Breeding Institute had been in existence for some time, but the new Institute would incorporate with the scientific side the skill and commercial knowledge of the practical man. It was for the miller to place before the scientist the needs, difficulties, and problems of his trade. Undoubtedly English wheat had been rapidly deteriorating in recent years, and it was to arrest this that plant-breeding research had been started, and it was now desired to develop it on the commercial side.'

INSECT NOTES.

INSECT PESTS IN ST. LUCIA, 1917-18.

The annual report on the working of the Agricultural Department, St. Lucia, for the year 1917-18, which is reviewed on p. 285 of this issue, contains a section on Insect Pests and Fungus Diseases. The portion dealing with insect pests, which is reviewed herewith, consists of a report by Dr. J. C. Hutson, acting Entomologist, Imperial Department of Agriculture, on the Black Weevil Borer of Banana, with notes on other insects; and notes by the Agricultural Superintendent on a few miscellaneous insects.

Dr. Hutson visited St. Lucia in July 1917 for the purpose of investigating the habits of the black weevil borer of banana (*Cosmopolites sordidus*). Bananas and plantains are not grown in St. Lucia as definite crops, but they are to be found in small clumps or patches all over the island, and these plants are used as wind belts and temporary shade in young cultivations of cacao. Dr. Hutson's investigations were mostly carried on in connexion with scattered clumps of bananas and plantains in the plots of peasant proprietors on the slopes of the Morne, above Castries.

Several different varieties of banana are grown in St. Lucia, such as the plantain, the Makabou (the bluggoe of Grenada), the Gros Michel, and the fig banana.

The black weevil was found wherever these different varieties were examined, and it is probable that the black weevil borer occurs wherever the banana is grown in St. Lucia. This insect was found to attack all the varieties of banana mentioned above, but it seems to prefer the plantain, with the result that the plantain is going out of cultivation and the Makabou taking its place.

The borer was not found in young banana clumps which had been recently planted. All the material for investigation was obtained from the older stools, many of which were in an abandoned and neglected condition, and in stools which had been planted within two or three years and had not suffered very much from the attacks of the borer. An interesting description is given of a typical neglected and overgrown stool of plantains, infested with weevil. A clump of this type is made up of a number of shoots of different ages all crowded together very closely just as they originally grew, no attempt having been made to prune out any suckers, except such as had been taken for planting new land. The original parent bulb, or at any rate the oldest bulb in the stool, was generally found to be in a more or less decaying condition, and riddled through and through by the tunnels of the black weevil grubs. This stump, however, was still fairly firm and had not broken up at all. In no instance were any weevil grubs found in any old stumps of this description.

Next in point of age there might be some two or three daughter stems which had already borne, and had been cut down leaving, in some cases, a stump 2 or 3 feet high. Sometimes these stumps had fallen over, while those that remained standing could easily be pushed over. The underground bulbs were usually pretty well riddled with tunnels and discoloured but in no way disintegrated. Occasionally a few larger grubs and pupae were still to be found in the tunnels. Then, next in succession there might be some two or three stems in the early fruiting stage, ranging from stems from which the flowering shoot had not yet emerged to those which were bearing a small bunch of fruit. These plants were still, as a rule, in a fairly vigorous condition, and could very seldom be pushed over. The bulbs when dug up and examined were usually found to be attacked by the grubs of the black weevil in all stages of development, and sometimes pupae or newly issued weevils were to be seen in their cells.

Of the young suckers of different sizes which may be seen pushing up all over the clumps, the larger ones are sometimes slightly attacked on the side nearest the parent bulb but a cross section through the sucker at the point of attack showed that the grubs had only barely cut into the outer surface of the sucker, and then probably turned back into the parent bulb again.

These young suckers were examined for the tunnels of newly hatched larvae, but instances of these could not be found, so that it seems likely that the weevils are not attracted to young suckers under St. Lucia conditions. Several newly planted suckers were examined for grubs of the weevil but in no instance were any grubs found in such plants. It would appear from the foregoing that there is a period during the life of the banana plant when it is most attractive to the egg-laying weevil. This period appears to be, in St. Lucia, the time when the flower and fruit are being developed.

The weevil begins to lay its eggs in the plant about the time that the flowering shoot is in the process of developing with the bulb as a reservoir of food for the future bunch, or even at some time previous to the formation of the shoot, and that it continues to breed in the bulb till the tissue has begun to deteriorate. The process of deterioration is probably hastened by disease, and by the attacks of the grubs themselves.

During this period of infestation the weevil appears to pass through several generations, the bulb being more and more riddled by each successive generation.

In the matter of control, the need of good cultivation is strongly emphasized. It should be the aim of every banana grower to keep his plants in as healthy a condition as possible all the time, so that the bunches may be fully developed before the attacks of weevil grubs can reduce the food supply stored up in the bulb and thus indirectly impair the size of the bunch of fruit.

The disposal of the stem and the infested bulb after the bunches of fruit have been cut is a problem not easy of solution. It has been recommended for Jamaica that these be cut in thin pieces and spread out on the ground. Such pieces should serve as traps to attract the adult weevils, and these should be collected from time to time. If the old banana material is cut in small enough pieces, it is not likely that the grubs would be able to develop in them; but this is a point on which definite information does not seem to exist.

The introduction of the predaceous Histerid beetle from Java to prey upon the weevil is suggested as likely to be a useful measure.

Other insects attacking the banana in St. Lucia are the large Dynastid beetle (*Tomarus bituberculatus*) which attacks the newly planted bulbs of plantain and the Makabou banana, and also attacks young tannias and dasheens; and the striped weevil borer (*Metamasius sericeus*) which is well known as the weevil borer of sugar-cane.

Limes were found to be attacked in St. Lucia by the adults of *Diaprepes abbreviatus*, var. *punctatus*. *Diaprepes abbreviatus* is known in Barbados as the root borer of sugar-cane. The adults and egg masses were found on the leaves of the lime trees, but no observations were made on the attacks of the grubs on the roots of these trees.

The purple scale (*Lepidosaphes beckii*), the snow scale (*Chionaspis citri*), and the green scale (*Coccus viridis*) were common on trees that were at all neglected or suffering from insufficient drainage. The white-headed and red-headed fungi were abundant on the purple scale and the black fungus

occurred occasionally on the snow scale. The small metallic bluish green lady-bird (*Exochomus nitidulus*) was also observed on the lime trees infested with scale insects.

A small lemon-yellow to yellowish-green beetle was observed on leaves of limes in the Soufrière valley. These beetles are leaf feeders and produce a notching of the margin of the leaves. This insect is (*Neocyphus* [Germariella] *pudens*), which is common in Montserrat.

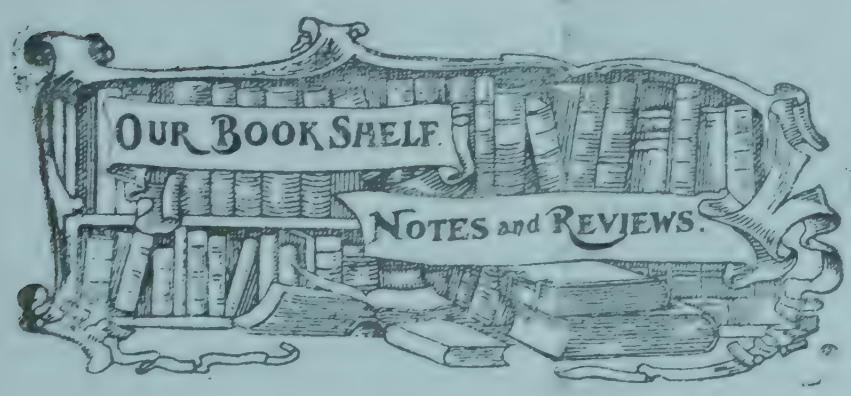
Mole crickets are reported as doing some damage to lime seedlings at Réunion Estate. Several birds feed on the mole cricket. Once a small gaulding or heron, known locally as Caille, was seen searching for this insect in the grass walks which were being badly attacked by the mole cricket.

Mahogany trees (*Swietenia Mahagoni*) were attacked by a small caterpillar boring in the twigs. This was afterward identified as (*Hysipyla grandella*, Zell.) The insect attacks the Honduras mahogany (*S. macrophylla*), and the Cedar (*Cedrella odorata*) more readily than the native mahogany. The cutting off of infested twigs is the only remedial measure suggested.

Mr. C. B. Williams, the Entomologist in charge of Froghopper Investigations in Trinidad, visited St. Lucia for the purpose of ascertaining if the sugar cane froghopper occurred in that island, but though careful search was made in the sugar-growing districts the pest was not found.

During the year under review reports were received of grass-hoppers defoliating young orange trees. The grass-hoppers proved to be a species of Microcentrum. They feed at night and hide by day. They are attacked in the early morning by the black bird (*Quiscalus* sp). On account of the abundant rain at the time of the attacks spraying with lead arsenate proved to be of no avail.

H.A.B.



THE STAPLE TRADES OF THE EMPIRE. Edited by Arthur Percival Newton, M.A., D. Litt., B.Sc. London & Toronto. *J. M. Dent & Sons, Ltd.*, Price 2*s.* 6*d.* net. Pp. 184.

This comprises a series of lectures delivered within the University of London at the London School of Economics and Political Science in the Spring of 1917. The course was planned under the auspices of the Imperial Studies Committee of the University and the Royal Colonial Institute, but for the views expressed in his lecture, each lecturer alone is responsible, the task of the committee being solely to ensure that each trade should be dealt with by someone who could speak with authority concerning it. The series comprises the following lectures: Oils and Fats in the British Empire, by Sir A. D. Steel-Maitland, Bart., M.P., His Majesty's Under-Secretary of State for the Colonies; The Sugar Supply of the Empire, Its Production and Distribution, by C. Sandbach Parker, M.A., C.B.E.; The Cotton Resources of the British Empire, by John A. Todd, B.L., Professor of Economics, University College, Nottingham; Metals as the Base of Imperial Strength, by Octavius Charles Beale, ex-President and Representative of the Associated Chambers of Manufacturers of Australia; The Wheat Supplies of the British Isles, by Hugh R. Rathbone, M A., Member of the Royal Commission on Wheat Supplies, Member of the Mersey Docks and Harbour Board, etc.; The Importance of Imperial Wool by E. P. Hitchcock, M.A., Raw Materials Department of the War Office.

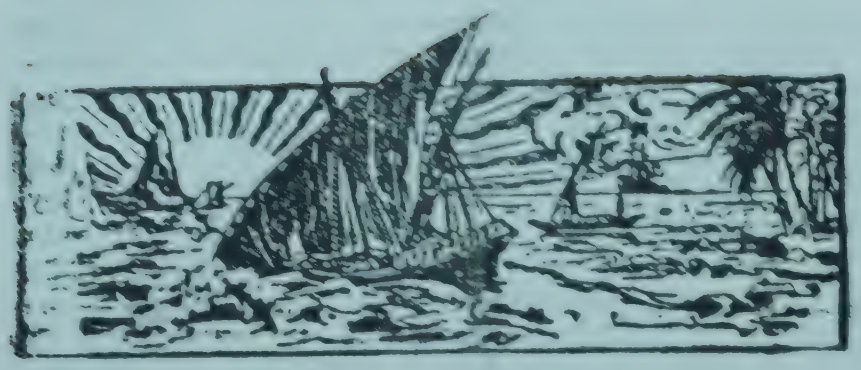
In these lectures attention is mainly directed not to the raising of the products, but to their distribution from the producer to the consumer through the processes of commerce.

Regarding the trades dealt with, those to which greatest interest and importance will necessarily be attached in these West Indian colonies are those which form the principal staple products of these colonies, viz.—taking them in the order of local importance—those dealing with sugar, cotton, oils and fats. In each case the trade has been dealt with by an expert who can speak with first-hand knowledge, and the very large volume of data and information supplied, cannot fail to be of value and use in carrying out such proposals and recommendations as may be finally agreed upon for the further development of these staple trades of the Empire.

The lectures that are here printed afford an illustration of the fact that the best 'practical man' may also be a scientific thinker about the conditions of the trade to which he has devoted his energies, and may supply within the very narrow limits assigned, a survey of the actual conditions of certain great branches of commerce at the present day. Each lecturer dealt with his subject not merely from the historical standpoint, but also with the design of indicating the conditions that will govern future developments, and of emphasizing the steps that, in his opinion, are necessary to secure the greater benefit of the Empire as a whole. Though the treatment of the commercial questions dealt with has been entirely independent in each case, it will be noted that a considerable unanimity of opinion is evinced by the lecturers, as to the direction in which future efforts must be made if the British Empire is to recover in full strength from the losses of the war and of the period of slackness and easy-going indifference that preceded it.

This can but be regarded as an expansion of the idea conveyed in the words of the Royal Commission on the Resources of the Dominions with which the introduction concludes, namely, that 'it has been a commonplace for years that British manufacturers and merchants should be stimulated to study and cultivate the Dominions' markets, and to produce goods of the nature and quality which are required by consumers across the seas. It has equally been a commonplace that the manufacturers of the Mother Country should be urged to use the vast resources of raw materials which the Dominions possess. The difficulty has lain in suggesting acceptable measures for the realization of these ideals. Hitherto the proposals made have been mainly the work of advocates of some particular fiscal or other theory, which they have pressed, in season and out of season, as a universal remedy. In our judgment, these counsels however important they may be, cover only a part of the problem. An Imperial policy in the broadest sense must include much that is not fiscal. There is no short cut to the formulation of such a policy; what is needed is detailed examination of existing conditions, and practical and definite proposals for the removal of difficulties and for securing co-operation.'

The present volume is regarded as a small contribution to that task of detailed examination. A book such as this can safely be commended to the general reader, who will amply be repaid for the time spent in its perusal.



GLEANINGS.

The *Colonial Journal*, July 1918, is responsible for the statement that, in some countries very sweet honey is extracted from the ripe cotton plant, and it should be more generally known that this is one of the best honey-yielding plants. The honey granulates readily.

A number of factories in Natal extract the wax from the filter-press cake, using the benzol process. The filter-press cake contains up to 17 per cent. of wax, and 14 per cent. is common. This is where the cane is trashed, but should the cane be burnt, the percentage decreases to 10 and less. (The *South African Sugar Journal*, May 1918.)

The Commissioners under the Vegetable Produce Act, Barbados, give notice under date August 29, 1918, that the dates for reaping provision crops under existing Orders having expired, until further notice provision crops now growing may be reaped at the discretion of planters, provided such crops have arrived at the maturity fixed by the Orders for planting.

The *Scientific American* describes a newly designed machine for cracking the coco-nut and freeing the kernel. This is operated solely by centrifugal force, the whole nuts being fed into a rapidly revolving drum, and driven violently against a continuous stationary belt of breaker blocks lining the inside surface of the main drum-shaped casting. (The *Australian Sugar Journal*, June 6, 1918.)

Rhodesia is becoming a promising ground for the production of certain oil seeds. At present only ground nuts and sun flower seeds are produced commercially: the cultivation of both is increasing, and the latter are likely to become a staple export. Castor oil seeds, sesame seeds, and linseed can also be produced (*Bulletin of the Imperial Institute*, Vol. XV, No. 4.)

Well decomposed stable manure is the best general purpose fertilizer for lawns. It contains all the chemical elements essential for plant growth, and adds humus to the soil, thus making it more retentive of moisture, and also improving its texture. If this can be used, a heavy dressing should be applied. A ton to 2,000 sq. feet would not be too heavy. (*Bulletin No. 281*, Michigan Agricultural College.)

An Ordinance (No. 29 of 1917) has been passed in Trinidad, which provides that no person shall acquire any interest in the oil-bearing lands, without the written consent of the Governor. It is retrospective in operation, and applies to all interest previously agreed to be acquired. The object is to safeguard fuel oil for the Navy, and the Ordinance is to remain in force during the war and for six months [illegible]

According to the *Produce Markets' Review*, June 22, 1918, operations are in progress for the erection of a plant on the Brisbane River for the manufacture from molasses of an acetate of lime which will ultimately be utilized for certain purposes; this may eventually involve the use of a very large quantity of molasses which annually runs to waste in Queensland. The enterprise is understood to be in the hands of the Commonwealth authorities.

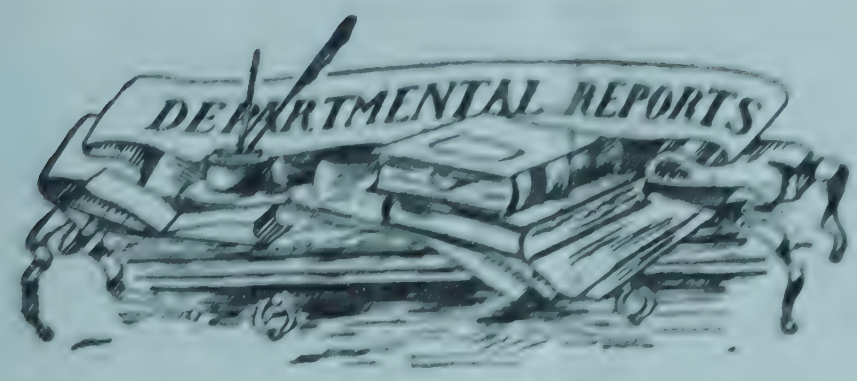
Experiments made in Java seem to prove that, in the case of Hevea rubber, the latex flows in a horizontal as well as in a vertical direction. The horizontal flow is less rapid. Experiments made on a number of trees of equal yield show that the maximum latex flow occurs at 6 a.m. and not at 10 a.m. A crooked incision yields as much as a V incision, the total length of the two branches of which equals that of the crooked incision. (The *Colonial Journal*, July 1918.)

It is satisfactory to find, writes the *West India Committee Circular*, that the Agricultural Society of Trinidad and Tobago shares the views expressed by the West India Committee, that enough attention has not been given to cacao as a food. When quite lately the Cacao Committee of the Trinidad Board of Agriculture was consulted as to the fixing of a minimum price for that product in London, stress was laid on the necessity of impressing the Food Controller that cacao should no longer be treated as a matter of luxury, but as a food.

The West India Committee have received intimation that the Government have decided to give to the signatories to the Brussels Sugar Convention the requisite six months' notice of their intention to resume complete liberty of action with regard to their sugar policy. This is in keeping with the pledge given to the signatories in 1913 when Great Britain withdrew from the Convention that a preference would not be given to British Colonial sugar or to cane sugar over beet sugar without first giving the signatories six months notice.

The *Chamber of Commerce Journal*, July 1918, referring to the reported discovery in 1917 of a new deposit of molybdenum at Lier, Norway, states that the deposit was at once bought up by a group of Christiania business men who proceeded to test the metal. The work has now advanced to a stage where it can readily be seen that the new deposit is an extensive one, and the metal of a good quality. The metal is found in quartz veins, the ore-bearing veins having a breadth of 5 c.c. (2 inches), but the metal itself is in such concentrated form that it can be prepared for the market with a minimum of labour.

As a result of the restriction of trade due to the curtailment of shipping between the Far East and Europe, difficulty has arisen in the disposal of the copra crops in the Malayan Peninsula. This has led to the revival of proposals, says the *Chamber of Commerce Journal*, July 1918, to extract coco-nut oil on the spot on a larger scale than hitherto, and it is understood that the Federated Malay States Government, with the view of encouraging the establishment of local oil mills, will grant a site for a factory at a nominal rent, and will also grant a loan against mortgage. It is estimated that a minimum of 7,200 tons of copra per year or 14,000 acres of coco-nuts in bearing, would be required to supply the erection of a [illegible]



ST. LUCIA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1917-18.

This report which has recently been issued contains much of interest to the general reader. In common with the other West Indian colonies, St. Lucia has evidently been experiencing difficulty with regard to the exportation of the products of the chief industries, owing to shortage of shipping facilities. This difficulty appears also to have affected the sugar industry, through the deficient supply of artificial manures obtainable. The fair results attained during the year in regard to this industry would seem to be entirely due to the perseverance of the estate managers, who in some instances considerably increased their expenditure on tillage in an effort to minimize, as far as possible, the shortage in production which must have resulted in the absence of fertilizers. In a small colony like St. Lucia, it is not possible to throw out large areas of land to lie fallow for any length of time, and to take up new land, as is the practice of larger colonies. It is therefore not difficult to foresee that unless the sugar planters are given some practical assistance in procuring the manure they require, the sugar crops will diminish year by year, and sugar being the mainstay of the agricultural industries, the future must be viewed with some misgiving.

Judged by the exports alone the cacao industry would appear to have received a set-back, the export of this product during the year under review being the lowest recorded since 1901, and 2,851 cwt. less than the previous year; but the falling off is in great measure again attributable to the difficulties experienced in shipping, and also to the fact that larger quantities of native cacao are being used locally. There is also recorded an apparent falling off in the lime crop, as shown by the export returns. This falling off is due to large supplies of juice remaining on hand at the close of the year through lack of shipping opportunities. Steady progress was however maintained in the green lime trade, and it is satisfactory to note that the St. Lucia brands continue to secure the highest market prices. The total value of lime products exported during the year was £6,945. Continued attention is being given to an extension of the areas under coco-nut cultivation. Large areas are now coming into bearing and it is anticipated that the exports of coco-nut products will in future be greatly increased.

In regard to minor industries, the closing down for a portion of the year of the private factory for the distillation of bay oil is to be regretted, for the reason that the trade in bay leaves is capable of being developed into quite an important peasant industry, there being no scarcity of leaves. On the other hand, it is satisfactory to note that bay rum was manufactured for the first time, and disposed of locally, and it is hoped that this article will be included in the list of exports of the colony in the near future. Lime planting having become general, increased attention is being given to bee keeping by lime growers, the value of bees in fertilizing the flowers and thus producing larger crops of fruit having been more generally recognized. Owing to the difficulty experienced in obtaining imported leather, increased attention has also been given to the tanning of locally produced hides. These are purchased direct from the butcher, and tanning is carried out in each district of the island. It is estimated that three-fifths of the total leather now used in the trade is locally tanned. The increased attention given to this minor industry is reflected in the exports of hides, which show a decrease of 6,570 during the last two years. Although comparing favourably with some of the inferior grades of American leather, the best quality produced at the St. Lucia tannery is said to leave much room for improvement.

A considerable amount of time and energy appears to have been devoted by the agricultural officers throughout the year in dealing with the question of the local food supply, and in taking steps to prevent as far as possible any serious hardships that may have resulted through the threatened shortage of imported foodstuffs from the United States and Canada. After careful investigation it was decided that the best practical results would be obtained by devoting special energies to the production of sweet potatoes, cassava, and corn. As a result a Government corn granary and a depôt for dealing with locally grown ground provisions were established. Following on this a farine plant at Bennion Experiment Station was also erected. Sweet potato meal has been manufactured on a commercial scale at Réunion, and supplied to local bakeries for mixing with wheaten flour for bread making. More than 23,000 lb. of farine and starch were manufactured at the farine factory, and supplied to public institutions and to the general public for local consumption.

Interest in the introduction and distribution of new botanical species has been maintained. A consignment of 3,000 seeds of *Swietenia macrophylla* was obtained from the Agricultural Department, Trinidad. Plants are being raised to enable this valuable tree to be distributed throughout the island. Seeds of a drought-resistant strain of alfalfa were received from St. Croix through the Imperial Commissioner of Agriculture, and sown in a dry light soil with full exposure. The plants grew bushy, to an average height of 9 inches, and flowered profusely. When sown in more humid beds they were killed out by a fungus. The green-dressing plant (*Dolichos Hosei*) has continued to spread vigorously. Planted a year ago between permanent crops of oranges, grape fruit, mangoes, etc., it has made a dense compact covering of the soil over large areas, and in numerous places is now over 1 foot thick. Mr. Brooks, the Agricultural Superintendent, regards this as being by far the most successful green-dressing plant introduced, as it is permanent and requires little or no weeding. The ajowan plant (*Carum copticum*), which yields thymol, has been successfully grown at Reunion. Each trial has clearly shown that this plant can be successfully grown, and without any particular care. It thrives in very light soil, with full exposure to the sun, and without any care beyond forking the soil, scattering the seed and then breaking the lumps with a hoe. Under this treatment at Réunion the plants grew to an average height of 14 inches, and produced a good supply of seed. Under more generous treatment, with a copious supply of moisture, the plants made greater growth, but the production of seed was not so great.

The officers of the Agricultural Department are to be commended for their energetic efforts in many directions, and for the effective way in which the varied work of the Department is being conducted.

PLANT DISEASES.

DISEASES OF COCO-NUTS IN JAMAICA.

Two leaflets recently received from Mr. S. F. Ashby, Government Microbiologist, Jamaica, embody the information obtained so far in the investigation of coco-nut diseases in that island.

The differentiation of bud rot into two distinct diseases, one of which is believed to be of fungus origin, is particularly interesting and important. The view which for a number of years seemed justified by the available evidence was that bud rot in the Western Tropics was solely bacterial in its nature, while the similar disease of coco-nut and other palms in the East was due to a fungus of the genus Pythium. This has recently had to be modified owing to reports of bacterial disease in Malaya and elsewhere, and it seems that as a result of Ashby's discoveries in Jamaica the converse modification is necessary as regards the Western forms.

Ashby's description of the two types met with in Jamaica is as follows. In the first type, which is presumably still to be regarded as bacterial, 'one or more fruiting bunches begin to drop the young nuts, followed by a breaking down of the limbs. In this type weeks or months may elapse before the disease reaches and kills the heart, so that as a rule ample warning is given of the progress of the disease.

'In the second type of bud rot the first symptom noticed is a drooping of the heart leaf which soon dies and dries up. This form of the disease gives no warning, as the tree is dead before anything wrong is noticed. This kind of bud rot is now very widespread in St. Thomas and Portland. It has been present in these parishes for years, but the hurricane of September 1917, followed by much rain towards the end of that year has caused a great increase of the disease since February 1918.

'The disease is due to a fungus which causes pale or dark brown spots to appear on the bases of the limbs round the heart. The fungus gradually eats its way through the strainer or thicker parts of these limbs until it reaches the heart of the tender cabbage, which is rotted quickly and changed usually into a soft, stinking mass. It is only when the rot has reached into the heart of the cabbage that the heart leaf droops, dies, and dries up. The spots on the leaves and strainer of the limbs round the heart are not as a rule large enough to cause these leaves to appear diseased, so that the death of the heart leaf is the first symptom to be seen, and then it is too late to try to save the tree.

'As soon as a tree shows a dead heart leaf it must be cut down, the buds split open, chopped up, and thoroughly burnt so as to be charred to the centre. It is not enough to chop off the limbs and make a fire on and around the unsplit buds, as such fire usually does not reach into the heart. The bud must be split open and chopped into a number of pieces so that all the rotted parts get destroyed by the fire. The fungus frequently causes sodden spots in the fibrous parts at the top of the stem below the cabbage. In such cases the top of the stem showing these spots must be cut off and burnt with the bud. Cutlasses and axes used in splitting and chopping up the diseased buds should be flamed in a fire on the spot until the iron is too hot to be touched by the hand.

'It is very necessary that the prompt destruction of trees killed by bud rot be continued, as the disease may remain dormant in the tops or the older limbs for many months (as long as two years in India) before penetrating into the heart.

'Bud rot attacks trees of every age, from the youngest to the oldest. It is usually worst on deep rich alluvial soils in wet districts; in these localities the trees make a very rapid sappy growth, bear early and heavily, and seem more susceptible to the disease than slower growing, later bearing trees on poorer lands and hill lands, and also in drier districts. Trees in well-drained land appear to be less susceptible to the disease. The fungus of bud rot may cause rows of spots to appear on living heart leaves, giving rise to one kind of Leaf-Bite disease (Phytophthora or Pythium Leaf Bite). Such trees very probably die finally from bud rot.'

The leaf-bite diseases here referred to are dealt with in a second leaflet. 'At least four forms can be distinguished in the fields of which the causes were different. During the last couple of years two kinds have become very conspicuous in north-eastern parishes, three of the forms are caused primarily by vegetable parasites, and in each of them the heart leaves are the first part to be attacked, before being pushed out into the light. As attack occurs while the leaflets are pressed together on the stalk, they are killed down to the same level, giving a chopped off or bitten off appearance to the leaf when finally pushed out, hence the popular name.

'The most frequent form of the disease is caused by the pineapple fungus (*Thielaviopsis paradoxa*, von Hohnel), another widely spread but less frequent form, probably by a small yeast. The other kind due to a vegetable parasite is caused by a downy-mildew (*Phytophthora* sp.), and is more local and rare. The further kind due to the rhinoceros beetle (*Strategus* sp.) shows the leaves torn or pierced. For convenience the forms may be named:—

1 Pine-apple Leaf-Bitten Disease
2 Hand or Little Leaf-Bitten Disease
3 Phytophthora Leaf-Bitten Disease
4 Rhinoceros Beetle Leaf-Bitten Disease.'

The symptoms of the first (pine-apple fungus) type are given as follows. 'The younger green unfolded and unfolding leaves appear bitten off at the ends or show successive leaflets lower on the stalks broken or reduced to stumps. Those nearest the heart show spots on successive green leaflets which bend over or break and hang down at these points.

'Leaves just pushing up can be detected with black tips; if the end of the heart leaf is cut out with the white leaflets overlapping and pressed on the stalk, characteristic discoloured patches and spots will be seen. Infection usually starts as a yellow discolouration with a brown edge along a narrow line beside the ribs of the leaflets: the infection runs across all the leaflets overlapping at that point. These long narrow spots widen to wedge-shaped patches with dark brown, broad edges and a pale-brown centre, with the skin raised into a blister, so that it can be torn off to expose the fibres with the tissue between them more or less decayed away.

'If infection is high up, only the tips of the leaflets become black. A heart leaf may show one or more wedge-like patches of disease. Spots are also present on the leaflets, at first minute, round or oval, yellowish with depressed centre, later with pale-yellow centre and brown edge: by union these become patches: in bad cases the leaf-stalk (rachis) beneath the diseased leaflets is attacked by a dark-brown rot, so that when pushed out the end of the limb may break off. Spots and patches show black specks consisting of spore masses of the fungus. The frequency of infection beside the ribs of the leaflets is due to a line of thin cells there, which regulate the opening and closing of the mature leaflets in dry and moist air, so as to control evaporation of water from the leaf pores, which are confined to the under

'The disease, as already pointed out, starts on the heart leaves while still white and tender, before they push into the light. Just what conditions favour the infection cannot be stated yet. Check to growth during a period of drought may have started it at some estates, while the last two unusually wet years have made it epidemic.'

The presence of this disease seems to lay the tree more open to attack by bud rot, and it is also being followed by *Metamasius sericeus* (the weevil borer of sugar cane) which is attracted to the rotting patches on the heart leaves and does a limited amount of damage by enlarging the injuries.

The basis of the treatment now adopted consists in stopping back the whole bud until no discoloured leaflets show in the heart. A mixture of salt, lime, and copper sulphate is then applied to prevent re-infection.

The second type (hard or little leaf-bitten disease) is more widely spread but not so definitely epidemic. The description is as follows:—

'As a rule short limbs can be seen in any part of the crown with a bitten off appearance of the foliage; the leaflets are frequently reduced to short, dry stumps, and the limbs brown and dried up. Such dwarfed, withered leaves are frequently mingled with normal green leaves, showing that for a short time good leaves may be developed. In a bad case all the youngest leaves in the heart remain dwarfed, and the ends wither up, giving the tree the appearance of having lost its heart, and resembling an advanced case of bud rot. Affected limbs which are still living show long, brown, raised, cracked and very hard patches on the upper surface. This condition may be present on all the leaves in the heart, and reach deep down into it. As the affected limbs and strainer become hard and unyielding, the youngest growth is held as if in a vice, if able to push out the leaves are dwarfed, and the leaflets deformed and twisted from having developed under great pressure. If the heart fails to push out, it hardens and dies, and the tree ceases to grow, and eventually dies. When such a bud is chopped open, the heart is found brown and hard, without odour, and with no signs of soft rot. If bud rot is prevalent in the cultivation, the tree may be killed by a secondary attack of that disease which may therefore follow both pine-apple and hard leaf-bitten disease. Trees not severely attacked by this disease may recover naturally, at least for a time; the bud leaves in such cases are shorter than usual, often curved or twisted, and may show cracks on the limbs from which a colourless gum oozes, hardening into reddish lumps.

'In the early stage of attack the leaflets and limbs show yellow spots, and after the brown, raised, cracked areas have appeared on the limbs, these are bounded by a yellowish, waxy-looking zone. Between the cells and these yellow spots and patches a very small yeast can be seen in quantity, and cultures have always yielded the same yeast, which as a rule, is the only organism to develop. The same yeast has been frequently found in a yellowish sodden rot of coco-nut trunks, sometimes in association with pine-apple fungus.'

The third disease, due to a fungus of Phytophthora type, is shown by Ashby's most recent work to be closely connected with the fungus type of bud rot already referred to. Yellow spots with brown edges are present on and run across a series of overlapping leaflets in the heart; a delicate mildew may be present on the spots. The affected leaves when pushed out into air and light show brown up to on the unfolded leaflets at the same level. The fungus resembles very closely, and seems likely to prove identical with *Pythium palmivorum*, the cause of bud rot of coco-nuts and of Palmyra palms (*Borassus flabelliformis*) in India.

W.N.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market for the month of July 1918:—

GINGER.

The month started with advanced prices for this article. Common to good-common Jamaica was quoted at 130*s.* to 135*s.* and medium to good, 140*s.* to 150*s.* Washed Cochin realized from 140*s.* to 160*s.*, and Calicut 135*s*, while Japan was quoted at 130*s.* At auction on the 17th of the month ginger was reported very firm, Jamaica fetching from 165*s.* to 175*s.* according to quality, and fair washed rough Cochin 180*s.*, while Calicut was quoted at 165*s.* Quite at the end of the month the ruling prices were as follows: Jamaica 160*s.* to 170*s*, Cochin 170*s.* to 180*s.*, Calicut 160*s.* to 170*s.*, and Japanese 125*s.* to 135*s.* Commenting on these prices the *Chemist and Druggist* says: 'The recent advance appears to be due to speculation, and consumers are disinclined to take interest at the much higher level of prices now prevailing. Second-hand dealers offer good Jamaica at 140*s.*, Calicut at 125*s.*, and Cochin at 140*s.* which prices are much lower than those asked by Mincing Lane operators.'

SARSAPARILLA.

This drug was in fair supply at auction on July 4, consisting of 29 bales of grey Jamaica, 22 of Lima-Jamaica, 40 of native Jamaica, and 10 of Honduras. Of the first, 25 bales were disposed of at 5*s.* 3*d.* to 5*s.* 6*d.* per lb. for fair fibrous, 5*s.* being paid for slightly mouldy. Ten bales only of the Lima Jamaica found buyers, fetching from 5*s.* to 5*s.* 1*d.* per lb. Of the 40 bales of native Jamaica only 26 were disposed of at from 5*s.* to 5*s.* 1*d.* per lb. None of the Honduras was sold, being limited at 5*s.* 6*d.*

ARROWROOT, PIMENTO, CITRIC ACID, CASSIA FISTULA, LIME JUICE, MACE, NUTMEGS, TAMARINDS.

At the first auction in the month, namely on the 4th, as many as 500 barrels of St. Vincent arrowroot were offered, and sold at from 1*s.* 5*d.* to 1*s.* 6*d.* per lb. for common to good manufacturing. Further sales were also effected at the same rate at the close of the month. Pimento has had a steady sale throughout the month at 6*d.* to 6½*d.* per lb. There has been a steady demand also for citric acid throughout the month, at from 3*s.* 5*d.* to 3*s.* 5½*d.* per lb. At auction on July 4, Cassia Fistula was represented by 30 packages, all of which were sold at 30*s.* per cwt. over previous prices, fair bold, part rattley from Dominica fetching 132*s.* 6*d.* Lime juice was in large supply at auction on the 4th of the month, some 56 packages being offered, all of which were bought in at 4*s.* 6*d.* per gallon for good pale raw. A week later it was reported that there was a steady demand for raw West Indian at from 3*s.* 9*d.* to 4*s.* 6*d.* per gallon. At auction on the 11th of the month mace and nutmegs were both in fair supply, the former selling at 3*s.* 5*d.* per lb. for fair quality, and the latter at 3*s.* 6*d.* per lb. for Penang 70*s.* A consignment of some 135 barrels of Antigua tamarinds were brought forward quite at the end of the month, and were disposed of at prices ranging from 98*s.* to 128*s.* per cwt. in bond; fair small, mostly dark colour, and pulpy. It was reported later on that a portion of this consignment had been re-sold at prices up to 140*s.* per cwt.

MARKET REPORTS.

London.—The West India Committee Circular, July 11.

Arrowroot—1/- to 1/5.
Balata—Venezuelan Block, 3/4½ to 3/7; Sheet, 3/11 to 4/3.
Beeswax—No quotations.
Cacao—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations
Honey—Jamaica, 175/- to 195/-.
Lime Juice—Raw, 3/3 to 4/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—5½*d.* to 6*d.*.
Rubber—Para, fine hard, 3/1½; fine soft, no quotations; Castillos, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., July 27

Cacao—Venezuelan, $11·10; Trinidad $11·75 to $12·40
Coco-nut Oil—$1·16 per gallon.
Coffee—Venezuelan, no quotations.
Copra—$6·25 per 100 lb.
Dhal—No quotations.
Onions—$4·00 per 100 lb.
Peas, Split—$8·00 per bag.
Potatoes—English, $5·00 per 100 lb.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros. & Co., July 12

Cacao—Caracas, 13c.; Grenada, 13c.; Trinidad, 12½c. to 13c.; Jamaica, 11½c. to 12c.
Coco-nuts—Jamaica selects, $42·00; Trinidad $40·00; culls, $20·00 to $21·00 per M.
Coffee—Jamaica, 9½c. to 11c. per lb.
Ginger—15½c. to 16½c. per lb.
Goat Skins—Jamaica, 85c.; Antigua and Barbados, 86c.; St. Thomas and St. Kitts, 85c. per lb
Grape Fruit—Jamaica, importation prohibited.
Limes—Importation prohibited
Mace—40c. to 45c. per lb.
Nutmegs—27c.
Oranges—Importation prohibited
Pimento—6½c. to 7c. per lb.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·05c, Molasses, 89°, 4·90c all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., August 6

Arrowroot—$12·00 per 100 lb
Cacao—$12·50 to $13·00 per 100 lb
Coco-nuts—$48·00 husked nuts.
Hay—$2·90.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $5·00

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Seedling Sugar-Canes.

IN his Presidential Address to the Royal Agricultural and Commercial Society of British Guiana, which is referred to on another page of this issue, Professor J. B. Harrison, C.M.G., M.A., discussed the general outlook as regards seedling sugar-canes, with especial reference to their stability, and the manner in which their production is best undertaken. These remarks, embodying as they do the experience of one of the principal workers in this field of enquiry, extending over the whole period since the simultaneous discovery in the West Indies and in Java of the seminal fertility of the sugar-cane, carry very great weight; they are accordingly here reproduced in order to extend the publicity given to them, and to render them readily available to the readers of the *Agricultural News*. Professor Harrison said:—

'In 1897 investigators generally were of the opinion that once a new variety of sugar-cane was produced, that after its first period of excessive vegetative vigour had passed, its characteristics were fixed for all time. Soon after the cultivation of the new varieties had been extended over large areas, it became painfully evident to the majority of planters that their characteristics are not fixed, and that in many instances, characteristics which in the earlier years promised to make a variety of sugar-cane of high value both in field and factory, were the first to fail. This tendency towards senile degeneration renders it necessary to raise new varieties of seedling canes year after year, in the hope of having fairly good varieties available to replace others which may gradually fail.

'Experience has proved to us that it is very easy indeed to raise new varieties of sugar-canes which are of high promise as plant canes. It has further proved to us that it is relatively difficult to obtain sugar-canes capable of producing good crops as plant canes and as first ratoons; and that it is exceedingly difficult to produce varieties which can be relied on to give satisfactory crops of plant canes, 1st, 2nd, and 3rd ratoons. Few indeed of the enormous numbers of new varieties which are now raised each year in various parts of the

tropics will do this, and the problem of getting good varieties for cultivation under the long-ratooning system necessitated here by our deficient labour-supply and dependence on hand, instead of on mechanical, cultivation, becomes an exceedingly difficult one. Elsewhere, with the exception of Cuba, sugar-canes are as a rule only cultivated as plants, or as plants and 1st ratoons. Hence as the best varieties raised in Barbados, Java, and Hawaii have been chosen for their suitability for short ratooning periods, it is rarely that a sugar-cane suitable for our long-ratooning conditions can be imported from elsewhere.

'The most successful method we have tried here for raising new varieties of sugar-cane of promise is based on the facts that a sugar-cane for successful cultivation on our heavy clay soils must be of well-marked vegetative vigour, and that whilst the range of variation in the saccharine content of seedling sugar-canes is very great, its relative sugar-content is a fairly fixed characteristic of any variety. We endeavour to raise as many seedlings as we can from varieties of proved vegetative vigour, and select from them those having both well-marked vegetative vigour and relatively high saccharine content. By this method we raised from D.625 the seedlings D.118 and D.419, the areas under which have increased from 2 acres, and 1 acre, respectively, for the crop of 1911-12, to 2,710, and 1,360 acres, respectively, for this year's reaping.

'We have been advised time after time to give up our proven methods and to confine our efforts towards raising canes by cross-fertilization. If we had in this colony sugar-canes of single parentage showing fixed characters and, through their purity of origin, having little or no tendency to mutation or sporting, that advice would be excellent. In India, and to a less extent in Java, sugar-cane varieties of high purity of strain exist; and with these it is possible that by the application of Mendelian principles in raising seedlings, new varieties of high value may be obtained. Up to the present, however, this has not taken place.

'At the inception of the sugar-cane breeding work here, Jenman was enthusiastic over the possibilities of raising new varieties of high promise by controlled methods of cross-fertilization; but in 1892-3 our hopes in that direction received a severe shock. Using a variety of sugar-cane, the Kara-kara-wa cane, which our experience in three preceding years had shown to produce seedling-canes having usually somewhat close resemblance to the parent variety, and placing it under conditions by which it was impossible for its arrow or flowering shoot to be either cross-fertilized by any other variety, or fertilized by any other flower shoot of its own kind, we got seedling canes from the one arrow of 267 different sorts. The parent cane in its own seedling stage was hence possibly derived from fourteen diverse ancestral strains.

'Supposing, for example, that we take two kinds of sugar-cane, one, X, having as ancestral kinds the varieties A, B, C, D, E and F, and the other, Y, derived from its ancestors A, B, G, H, I, and J, it is evident that 406 different combinations can arise from the interbreeding of the two kinds, instead of a single blend or cross, X × Y.

'By Mendelian segregation, the inheritable properties of this diverse progeny will fall into three groups. We do not know which properties are inherited; but assuming that the general characteristics as a whole are heritable, the segregation of the seedlings from the cross X and Y may give rise in the first generation to 1,218 *groups* of varieties.

'Now either X or Y, by interbreeding with its own kind, could produce only 15 × 3 groups or forty-five general strains of sugar-canes. The complexity introduced by the cross-fertilization of existent complex hybrids is well illustrated by this example.

'Up to 1902 we had not made any systematic attempt at raising canes of controlled parentage. We now do it as a matter of regular routine—not with any idea of getting seedlings having definite and desired characteristics, but as a means of greatly widening the range of their variation. We have complete proof of the success of the method in this line. Unfortunately, there is no chance in British Guiana of controlled cross-fertilization of the sugar-cane proving a short and certain way to success in the production of new varieties of high saccharine value.

'Probably a more disappointing investigation has never been pursued than has been the search for improved varieties of sugar-cane. There are now many stations at work at it in the tropics and sub-tropics; their results appear to be very similar; in the earlier years working with natural varieties of sugar-cane, several kinds of high promise are almost invariably obtained; in later years, when the mass of material for parental purposes has rapidly and enormously increased, the production of really good varieties appears to become increasingly difficult, and results satisfactory to both investigator and planter tend to be few and far between. It looks as though the good results arose

from the unravelling of the complex ancestry of the natural varieties, whilst similar results from the retangling of the new strains thus obtained are comparatively rare, and are very elusive.'

Those who are interested in the introduction of new seedling canes into their fields will, doubtless, in the light of these remarks, carefully consider the results which they are obtaining from their efforts. It will be observed that, in Professor Harrison's view, the work of finding promising seedlings is much more difficult when it is required to have canes that will ratoon well; when plant canes only are grown, the problem is relatively simple.

The question of the stability of seedling canes propagated by cuttings has long been under investigation. Some have held that these canes would prove stable, and indeed in the early days of the work this was the commonly accepted view: now, however, many are doubting this, and Professor Harrison appears to be amongst those who are convinced of the tendency towards early senile degeneracy on the part of these seedlings. It is observed that, in some districts where sugar-cane is cultivated, there is a tendency to substitute one new seedling after another in the hope of obtaining ever-increasing yields. Where adequate records exist, it would be well to examine these carefully, in order to see whether the newly introduced varieties retain their productiveness in full degree, or whether they fall off, so that the substitution of successive new varieties merely serves to maintain the sugar production at a high level, but does not tend to raise that level to the extent that is hoped and desired. Now that it is the commonly accepted practice on the majority of West Indian sugar estates to weigh the canes which are delivered to the large factories, and seeing that in the factories continuous analyses are made of the juice obtained from these canes, there should be in existence some data whereby it may be possible to learn something definite concerning the stability or otherwise of seedling canes during the years subsequent to their introduction into cultivation on a large scale.

Still the fact remains that the continued production of new seedling canes is a matter of moment for the sugar industry. This work affords means of combating many of the forms of fungus disease to which sugar-canes are liable, and it also affords the means of maintaining the level of production, even if it does not tend to raise that level so rapidly as was at one time hoped might be the case. It is therefore work essential for the well-being and development of the industry, and should be carried on continuously.

SUGAR AND THE TEETH.

In the course of a paper in *Farmers' Bulletin* 535, United States Department of Agriculture, on Sugar and Its Value as Food, there occurs the following information in regard to the effect of sugar on the teeth, which should be of interest:—

'It is often said that sugar is harmful to the teeth, but the facts seem to be as follows: According to the theory universally accepted, the decay of the teeth, technically called caries, is caused by bacteria, such as are found in every mouth, entering the soft portions of the teeth through defects in the hard outer covering. If acid is present in the mouth, and especially in the interstices of the teeth, it tends to eat into the enamel and thus provide an entrance for the caries-producing bacteria. Ordinarily, saliva is alkaline and protects the teeth against this danger, but when it is in contact with sugar or starch, acid is produced, hence a carbohydrate material lodged upon the teeth may be the indirect cause of caries. Some authorities hold that certain forms of sugar cause the flow of a less alkaline saliva, but this point is not fully established. In general, it is believed that starch is not as dangerous as sugar, and that the form and manner in which the material is eaten is a more important consideration than its exact chemical structure. Soft foods are especially likely to cause trouble, both because bits of them may remain on the teeth where they form "plaques" which are centres of bacterial action so long as they remain, and because they are swallowed without much chewing and thus do not rub the food "plaques" or other deposits from the teeth. Modern specialists consider that the cleansing action of proper mastication is as important for the preservation of the teeth as the regular use of a tooth-brush, important as this last is. Any soft carbohydrate food eaten alone is much more likely to leave a deposit on the teeth than if it is eaten in combination with other foods. If candies are eaten by themselves, they are more likely to cause the development of acid in the mouth than if they are taken during a meal. Some physicians advise finishing the meal with acid fruit for the sake of lessening the chances of carbohydrate material clinging to the teeth. While soft foods may possibly cause trouble, the hard ones may also be dangerous, especially to diseased teeth, as the effort to crush them may tend to increase flaws in the enamel. Such things as hard crusty food, hard candies such as lemon drops, stick candy, etc., may be dangerous in this respect, though investigations by G. V. Black on the crushing force of the teeth, have proved that sound teeth are capable of crushing much harder substances than these without injury.'

Medicinal Herb Growing.—Dr. David Ellis, Professor of Botany in the Royal Technical College of the University of Glasgow, has written a book to foster the growing movement for the revival of herb cultivation in this country [Great Britain], a movement which was organized with the object of supplementing the supply of some of the more urgently required drugs, such as digitalis, belladonna, and opium, at the beginning of the war. The industry, which now adds to a useful extent to the synthetic drugs, has greatly developed in the last two years, and private growers and collectors, thanks to good organization in several countries, have reinforced the efforts of the professional firms. The book, which is full of varied information on the subject, is entitled *Medicinal Herbs and Poisonous Plants*, and will shortly be published by Messrs. Blackie & Son.—*The Field*, July 1918.

ROYAL AGRICULTURAL AND COMMERCIAL SOCIETY, BRITISH GUIANA.

The Presidential Address delivered by Professor J. B. Harrison, C.M.G., M.A., etc., to the British Guiana Royal Agricultural and Commercial Society, the first part on February 4, 1918, and the second part on April 17, 1918, on the Society's work in the period of twenty-one years between 1897 and 1918, is published in *Timehri*, Vol. V, 1918. This address constitutes a review of the changes which have taken place in the society, and in the industries of the colony since January 1897 (the year during which Professor Harrison was President of the Society, and the West Indian Royal Commission made its enquiries and issued its report) up to the present time.

In 1897, Professor Harrison points out, the society showed more activity in practical pursuits than it has done of late years. It was not then as purely a literary or book-collecting society as it now is. Its agricultural and its correspondence committees were alert and active. The Professor regrets that this, the premier agricultural society of the West Indies, and the second in the Empire, in point of years of existence, has, in this respect, shown some lack of vitality.

After paying a fitting tribute to the efforts of his predecessors, and of his co-workers who have passed away during the interval, he proceeds to discuss the various matters in which the society had interested itself, and the progress which had been made during the twenty-one years under review. Professor Harrison refers firstly to the efforts that have been made in connexion with the promotion of agricultural education, and the proposals which years ago were brought forward, on his initiative, in regard to the establishment of (a) a central agricultural college for the West Indies, and (b) agricultural or farm schools in various districts of British Guiana. The society's interest in this highly important question appears to have waned during recent years, but still some interest had always been taken in it by certain of the members: and he often wondered whether any practical steps will be taken towards the establishment of such a school, but more especially of a Central West Indian Agricultural College, before his official connexion with these colonies terminates.

Regarding local foodstuffs, the society, it is shown, had devoted much attention in the early nineties towards the quality and purity of these, as also the conversion of locally grown vegetable products into permanent forms in which they may be stored: the latter, however, with scant success. Under present war conditions, the position with regard to locally produced foodstuffs has become very acute. As the outcome of a report and recommendations of a special committee, the Government was endeavouring to obtain from the United States, machinery for the equipment of a factory for converting rice and maize into ground rice, rice flour, and corn flour. The success of this should be assured, and should lead in the future to an export trade in ground rice and rice flour. It is hoped that it will also be feasible to equip the factory for the commercially successful production of various flours from plantains, bananas, cassava, various pulses, and ground provisions generally. Professor Harrison is careful to remind his hearers, however, that a factory of this sort working on a commercial scale is an entirely novel proposition. It is one which the society hoped would prove successful, but the success of which will be entirely dependent on the receiving of ample supplies of the various raw materials from planters and farmers. Unless the factory can work continuously, and at its full power, its failure is a foregone conclusion.

An address by Professor Harrison reviewing the work of this society covering a period of twenty-one years, must necessarily include more than passing reference to the question of soils—a subject to which the major portion of his life-work has been assiduously devoted. This, the Professor has amply dealt with, and it will receive fuller notice in a later issue of this Journal. So also with reference to the progress of agricultural industries, particularly the sugar industry. The portion of the address dealing with the raising and propagation of seedling canes forms the subject of the editorial in this issue, while other matters will receive attention later.

In regard to the rice industry, steady progress has been made, as is evidenced by the data supplied in the address under review. The area under rice cultivation in 1896-7, it is shown, was about 6,500 British acres, yielding paddy equal to about 4,000 tons of cleaned rice, in value about £48,000 or $230,000, whilst in 1917 not less than 63,580 acres were reaped, yielding paddy equal to about 45,000 tons of commercial rice, having a value in normal times of at least £540,000 or $2,600,000.

Coming next to the coco-nut industry, it is shown that there were, in round figures, 9,700 acres planted in the colony prior to 1911. If these palms had been planted at proper distances, and properly tended, the Professor states, there should now be about 390,000 trees in full-bearing, producing at least 15,000,000 coco-nuts a year. In addition, at least 2,300 acres should be commencing to bear, and their yields should increase the total to about 21,000,000 nuts per annum. The annual exports of coco-nuts is about 2,000,000 nuts. The copra exported annually represents about 325,000 nuts, and the coco-nut oil about 1,075,000, leaving apparently about 17,600,000 nuts available for local consumption. If he postulates, this is the actual position, then the community can look with equanimity towards the threatened scarcity of imported fatty food, for they will have the equivalent in food value of 6,750,000 lb. of butter or oleomargarine, or of 5,000,000 lb. of ghee and oil. But Professor Harrison is doubtful whether the colony does produce 21,000,000 coco-nuts annually. On the contrary, he expresses himself as being satisfied that, owing to lack of care in planting, uneven spacing, neglect of drainage and of tillage, the ravages of fungoid and insect pests, and especially lack of continuity in clean-weeding, the areas which should now be bearing are not producing nuts in numbers even approximating to those they should do. The exports of coco-nut products, however, have increased from 560 in 1896 to, in round figures, 1,911,000 nuts, 169,000 lb. of copra, and 26,674 gallons of oil in 1917, and these alone served to measure the reserve stock of fatty foods on which the colony might be compelled to rely.

In its agricultural activities the society has always been interested in coffee growing, and Professor Harrison recalls the fact that in the eighteenth century, and in the earlier part of the last century, Guiana, and especially Berbice, was celebrated for the high quality of the coffee produced: and that at the time of the cessation of slavery, circumstances beyond the control of the planters necessitated the gradual abandonment of its cultivation. There has been, however, a marked extension in coffee planting during the period under review, which has been carried out mainly, if not entirely, with the Liberian variety. Whilst progress with regard to coffee planting during the past ten years appears to be marked, Professor Harrison represents the industry in British Guiana to be practically in a deplorable state of stagnation, in comparison with that of their neighbours in Surinam. There, not only had the area planted with Liberian coffee been greatly augmented, but coffee was being grown on excellent cultural lines, such as were followed by very few indeed of the planters

in British Guiana, with the result that on plantations in Surinam—plantations having from, say, 400 to 800 acres of Liberian coffee in full-bearing—returns of coffee per acre were attained which, to growers having only local experience in British Guiana, were almost incredible.

Cacao planting does not appear ever to have been a prominent or even a very promising industry in British Guiana, it being, nevertheless, one of the earliest followed. Berbice appears to have been the part of the colony where in early days cacao was principally produced. The maximum export, 115,000 lb. in those early days, was in 1820. In 1896 the export was about 47,000 lb., increasing in 1897 to 105,000 lb., and attaining its maximum of 124,000 lb. in 1900. The present stagnation in the cacao industry, Professor Harrison thinks, has been largely due to the fact that the planters of cacao in the seventies to the nineties of the last century. were wedded and adhered to the Trinidad policy of densely shading the trees with the Bois Immortel or Oronoque trees, this practice, in his opinion, not being suitable to the conditions of British Guiana.

The address then deals more or less extensively, according to their relative importance, with the rubber industry, in connexion with which the late G. S. Jenman played so prominent a part; fruit, fibres, minor industries generally, the concluding portions being devoted to the varied mineral resources of the colony.

Regarding the mineral resources, these are among the chief fundamental industries of British Guiana. In addition to gold and diamonds, the recent discovery of bauxite is a matter of vital importance to the future development of the colony, having regard to the fact that British Guiana is the only part of the British Empire in which large deposits of this mineral exist, all other known deposits existing in foreign countries. Professor Harrison narrates the circumstances which led to the chance discovery by himself of the widespread deposits of bauxite in the Christianburg-Akyma district whilst President of the Society in 1897, in company with the then Curator of the Museum, Mr. J. J. Quelch—the latter in search of zoological specimens, the Professor enquiring into the physical nature of the soils. Professor Harrison by chance noticed the occurrence of small blocks and gravel of hard material all along the paths, from the riverside to the house at the summit of the low hill at Three Friends, Akyma. He collected samples and asked Mr. Quelch if he knew what the stuff was. Mr. Quelch said it was an indurated clay (exactly what it was), and that there were very wide areas of it in that district. Professor Harrison suspecting the concretionary mineral might be phosphate of alumina, afterwards analysed the specimens and found that they contained exceptionally high proportions of a hydrate of alumina. Thus to a chance visit of the then President of the Society, accompanied officially by the Curator of its Museum, the colony, and it may be added, the Empire, are indebted for the finding of the large superficial deposit of bauxite of the Guianas, which, with its vast water-power resources are among the most valuable of the potentialities of the colony.

Professor Harrison must be congratulated on the valuable and instructive fund of information which he has supplied in the address under review. He has dealt with the subject as only one of his long years of active experience, observation, and research in a colony possessing such diversified industries could be expected to do. Efforts such as these cannot fail to receive the full measure of appreciation from those immediately concerned; they should tend to revivify waning interest, and give stimulus to greater activities amongst members of the Royal Agricultural and Commercial Society.

PRODUCTION OF SANITARY MILK.

Experiments undertaken with the object of investigating and determining the four essential factors in the production of milk of low bacterial content are presented in *Bulletin No. 642*, of the United States Department of Agriculture. The summary of results with the conclusions arrived at, indicates, amongst other things, that in general the greatest contamination of milk comes from the use of unsterilized utensils, and that the use of small-top pails, that is pails with a hood on the top, was found to lessen the quantity of manure and dirt which may gain entrance into the milk, and to assist in lowering the bacterial count.

In view of the efforts taken from time to time by the proper authorities to ensure the production of pure milk, that is, milk free from dirt and other impurities (in contradistinction from fraudulent adulteration) in these islands, the chief of the conclusions reached are here reproduced:—

Milk of low bacterial content and practically free from visible dirt, when fresh, was produced in an experimental barn under conditions similar to those on the average low-grade farm.

Three simple factors were necessary for the production of milk with a low lacterial content, namely, sterilized utensils, clean cows with clean udders and teats, and the small-top pail. Washing the udder and teats of the cows not only caused a decrease in the bacterial content of the milk, but also more nearly uniform counts.

A study of the bacterial groups in the low count milk showed that they correspond closely to those in the milk drawn directly from the udder.

A practical demonstration of the value of the three essential factors was made on six farms. The results indicate that it is possible for the average farmer with inexpensive equipment to produce milk of low bacterial content with little extra work.

The results of the experiments indicate that it is possible for the average dairyman on the average farm, without expensive barns and equipment, to produce milk (practically free from visible dirt) which when fresh has a low bacterial count. By the use of the three simple factors, namely, sterilized utensils, clean cows with clean udders and teats, and the small-top pail, it should be possible on the average farm to produce milk which corresponds closely to milk as it leaves the udder of the cow.

In connexion with the production of milk of low bacterial content, and which is practically free from visible dirt, it seems evident from the results that undue emphasis has been given to factors and methods of minor importance, while those which directly affect the bacterial content have not been sufficiently emphasized.

Acid Phosphate versus Raw Rock Phosphate.—The superiority of acid phosphate over raw rock phosphate when applied in equal amounts, both alone and in combination with muriate of potash, lime or manure, is thought to be fully demonstrated in experiments involving rotations of corn, oats, and clover, conducted at Wooster for thirteen years, and of corn, wheat and clover in practice for twenty years, as indicated by both crop and money returns based on values prevailing up to 1914, and on current values. An experiment recently established, involving a rotation of corn, oats, wheat, and clover, and in which 480 lb. of acid phosphate and 768 lb. of raw rock phosphate, representing equal recovery values, were used, in addition to 8 tons of manure, has given the same relative results. -*Experiment Station Record*, May 1918.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. During the month of August work in the Botanic Gardens was of a general routine character. In regard to staple crops Mr. Sands states that the cotton crop continued to make good progress. There was some damage done by wind on August 22, but this was local, and not of a serious nature. The corn crop promised well, and reaping was started. Cotton picking will be in progress during the coming month. The Agricultural Superintendent, the Cotton Instructor, and other agricultural officers again devoted much attention to problems connected with the cotton industry, involving the control of cotton stainers, bush bugs, and in one or two cases, leaf-blister mite. The absence of cotton stainers and bush bugs in the fields in the lower Leeward Districts was particularly noticeable. At one estate, a few cotton stainers were found on bolling cotton plants which had been cut back last season and not stumped out in a field which was subsequently planted in cassava. The occurrence of leaf-blister mite in other places was attributed to a similar source of infection.

The rainfall for the month recorded at the Botanic Station was 17·14 inches; at the Experiment Station, 12·25 inches.

Attached to Mr. Sands's notes is a report on a visit to the Grenadines by the foreman of the Experiment Station, in connexion with the control of cotton stainers, bush bugs, and other pests in these islands. The presence of cotton stainers in many of the districts is reported. In one particular case, cotton stainers were seen on Marie Galante cotton plants, living on bits of seed-cotton left on the plants from the last picking, and on the bolls on a plot of ratooned Sea Island cotton. These bolls were badly infected with internal boll disease. The occurrence however is said to be local, as the examination of cotton bolls in plots situated about ½-mile or less away revealed no internal disease, nor were any cotton stainers observed in these plots. Attention is directed to the desirability of taking measures to prevent the spread of leaf-blister mite, which affects a large proportion of the Sea Island cotton in a section of the Grenadines. The foreman was not in a position to say whether the disease is increasing in magnitude from year to year, but it seemed desirable, in the interest of the Sea Island cotton industry of Union Island, that the operation of the Ordinance for the destruction of old cotton plants at the end of the crop should be extended to this island. As the pest does not appear to affect Marie Galante plants, he suggests that the established methods of growing this perennial cotton need not perhaps be interfered with. Only the destruction of the Sea Island cotton stalks may be necessary.

ST. KITTS. Owing to the very dry, hot weather of the past month it was found impossible to do any planting or distribution of cuttings during the month of August. From the Botanic Gardens 123 ornamental plants only were distributed. The usual routine work was carried on, and constant watering to keep the plants alive was necessary. The record of the past month, Mr. Shepherd states, is a very gloomy one so far as weather is concerned. The rainfall was only 2·28 inches, and rain fell on eight days only. From this it will be seen that the condition of the cane crop is very poor, and unless the rain comes soon and heavy, there is little promise of more than half the average crop being made. The ratoons especially are very poor, having had no artificial manure. The cotton crop has stood the dry weather well, and where planted early, the returns are very satisfactory. Picking is in full swing on the northern side of the island, and the yield per acre in this district will be above the average, as the weather has suited cotton. In the Valley District showers are needed to develop the bolls, which are opening prematurely. Cotton stainers have appeared at the experiment plots, and every effort is being made to keep them under control. A visit to the estates round the island showed that as a general rule the cotton crop is better than for many years past, and the cane crop very poor.

AGRICULTURE IN BARBADOS.

The spell of dry weather which prevailed during the latter half of August was broken by the very stormy weather which was experienced on the 22nd day of the month. The previous day was sultry and somewhat misty, but no one expected the cyclonic disturbance which took place within twenty-four hours afterwards.

On the 22nd there were light rains before the veering of the wind to the south. After the disturbance, which was purely local, there was a rain storm which gave 3 inches and a little more in portions of St. Michael, St. George, Christ Church, and St. Thomas. In St. Joseph and St. Lucy, 1½ inches was the result of the rainfall on this date, while at Haggatts in St. Andrew the total was only an inch.

From the 22nd to the end of August the southern and south-midland portions of the island received excellent showers—just what were needed to keep the surface of the earth from developing a hard crust. After the 22nd the northern and north-midland portions of the island again had a spell of dry hot days, but on the 30th there was a downpour in St. Thomas, St. James, St. Andrew and part of St. Peter. As a result of the rainy days subsequent to the 22nd ultimo, the rainfall for August, which seemed likely to be under last year's figure, exceeded it. Indeed, in some parts of Christ Church, last month's total lacked but little to be twice as much as that for August last year, while it very nearly reached the total of August 1916, when the whole island had a rainfall almost equal to the high record of 1886.

The cane crops quite held their own during the hot days of the latter half of August, and were ready to make good progress with the recent stimulating rains. It is a pleasure to view the fields at this time. Now that the artificial manure has thoroughly penetrated the soil and the cane roots have had sufficient time to take it up, each landscape presents an expanse of livid green.

The B.6450, which was somewhat behind the other seedlings in growth, has made rapid strides during the past few weeks.

So far there is no seedling of accredited value being grown for next year's crop except the three of which we have written in recent reports. In non-ratooning districts we would recommend that a small area of the B.6308 be kept on trial. We would also like to see the breed of the B.208 and the B.3922 kept going.

While the ratoons are generally green they appear very low after one has been observing a field of plant canes. They, of course, are but a few months old, and have yet to receive, in the red soil at least, a second application of artificial manure. Although most of the ratoons are fairly satisfactory, we have noticed several fields which are not improving with age.

The Vegetable Produce Act will prove a benefit to the land. Fields which would neither have been rotated nor

rested will be so treated for a short period at least. Perhaps the good results will prove an effective object-lesson and cause planters in general to apply one of the soundest principles of agriculture.

The cultivation of the fields for the crop to be planted at the close of the year proceeds apace. The black soil is well up and the initial tillage has been practically completed. In the red soil there is still much to be done.

The provision crops have revelled in the favourable weather of the past fortnight. Yams have made splendid progress, even though they may not be as advanced as we have frequently seen them at this time of year. There is hardly a field planted in this vegetable which has not received a fair share of manure. The spires look very healthy, and with favourable weather, in October particularly, this crop should give a satisfactory return.

The worm has been busy of late. We have seen several fields where the leaves of beans, woolly pyrol, and potatoes have been freely eaten. This is not unusual at this time of the year, and we hope that the potatoes will not be affected to any extent. Where the plant has reached the point of maturity this may not be the case, but the attack might retard the progress of younger fields. (The Barbados *Agricultural Reporter*, September 7, 1918.)

VARIETIES OF EGYPTIAN COTTON PRODUCED BY MUTATION.

Egyptian cotton is much in demand on the American market for the manufacture of articles requiring a high degree of tensile strength, such as sewing thread, durable hosiery, and motor-car tyre fabrics. At the suggestion of the United States Department of Agriculture, and under the direction of Dr. H. J. Webber, numerous comparative cultural experiments were begun in 1900 at agricultural stations in the South and South-west, using cotton seed imported directly from Egypt. These experiments, as summarized in the *Journal of Heredity* for February 1918, showed that it is possible to cultivate Egyptian cotton in the United States if it is grown on the irrigated lands of the South-west. Nevertheless, even under the most favourable conditions, the newly imported varieties produced little, ripened late, and varied greatly. This latter circumstance is probably due to the fact that, in Egypt the cotton fields are often exposed to cross-fertilization with hybrid varieties, particularly with the 'Hindi' cotton, which grows wild in the fields.

Careful selection was therefore required to obtain earlier, more productive, and more uniform types. Selection experiments begun at Yuma (Arizona) gave very satisfactory results in a few years, involving the improvement and gradual fixing of the desired characters without altering the structure and appearance of the original type, 'Mit Afifi'.

In 1908 a new era began with the unexpected appearance of two lines, obtained by selection, differing greatly from the parent stock, and from each other. These two lines gave rise to the Yuma and Somerton varieties. The second variety had to be discarded because of its excessive production of sterile branches, but the first became the basis of the Egyptian cotton industry in Arizona. This new variety differs from the Mit Afifi variety in longer and more pointed bolls, and in a longer (1½ inches) and lighter fibre.

Mr. E. W. Hudson obtained a third variety, Gila, from a plant selected in 1908 in a field of acclimatized Mit Afifi cotton at Sacaton, Arizona. Although differing less from the original stock than the Yuma and Somerton varieties, Gila is sufficiently distinct to be considered as a new variety.

The Yuma, Somerton, and Gila varieties are thus all derived from the Mit Afifi Egyptian cotton.

In 1910, in a field of Yuma cotton at Sacaton, a specimen was selected and kept separate because of its superior productiveness and length of fibre. From this plant was derived the Pima variety which differed from the Yuma variety in fewer vegetative branches and better developed fruiting branches, by its plumper, more sharply pointed, and less deeply pitted bolls, lighter, silkier and longer ($1\frac{5}{8}$ to $1\frac{3}{4}$ inches) fibre.

The new varieties spread rapidly, especially in the Salt River Valley, where they were grown over ever-increasing areas: in 1912, Yuma, 200 acres; in 1917, Yuma, 23,000 acres, and Pima, 7,000 acres (a total of 30,000 acres); in 1918 it is estimated that the crop will cover 100,000 acres.

The Yuma and Pima varieties supply first quality material for spinning and for motor tyres. Pima is preferred on account of its earliness and long fibre, and will undoubtedly completely supersede Yuma. It is not easy to solve definitely the problem of the origin of these varieties; certain phenomena point to roguing, whereas others point rather to true mutation.

Roguing. (1) Mit Afifi cotton probably originated towards the middle of the 19th century from hybridization of Sea Island with a brown-linted African tree cotton; (2) as has been already stated, Egyptian cotton fields are frequently exposed to cross-fertilization. Consequently the presence of many heterozygous characters would explain the frequent appearance of rogues.

Mutation. The following phenomena, however, are in favour of the mutation hypothesis: (1) the sudden appearance and fixation of the new types; (2) the total absence of forms intermediate to the original and new types; (3) the differential characters of the new type, which are entirely new, and of which no trace is found in the species of varieties of cotton which are likely at any time to have come in contact with Mit Afifi.

Rubber in North Borneo.—The area planted with rubber at the end of 1916, according to returns received from managers of estates says the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, May 1918, was 30,910 acres. Small holdings planted by Chinese and natives are not included in these figures. The amount of new land planted during the year, was only 529 acres. The number of trees in tapping at the end of the year was 2,030,150, or a little over half the total number planted, which is returned at 4,049,050. The area in full tapping was 14,720 acres as against 9,806 acres at the end of the previous year.

According to the figures supplied by the Customs Department, the export in 1915 was 1,937·7 tons, an increase of 84·4 per cent., on the total of 1,050 tons shipped in 1915. In January the price of smoked sheet reached 4*s*. 2*d*., but dropped quickly to about 3*s*. 6*d*., it then declined steadily until August, when it had fallen to 2*s*. 1½*d*., after which it rose to about 3*s*. in December.

The extension of tapping operations necessitated an increase in the labour force at most estates. At the end of the year the total number of coolies employed was 12,334, an increase of 2,698 over last year's total.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

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Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

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Assistant Typist	Miss W. Ellis.
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*Seconded for Military Service.

†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number gives prominence to the question of seedling sugar-canes as dealt with in the Presidential Address of Professor Harrison, C.M.G., to the Royal Agricultural and Commercial Society of British Guiana.

Insect Notes, on page 298, indicate the spread of the Mexican cotton boll weevil in the United States.

A further note on the coco-nut bud-rot, dealt with in the previous number of this Journal, will be found under Plant Diseases, on page 302.

Observations in reference to two West Indian cyclones on August 22, 1918 are given on this page.

Expansion of the United Kingdom Margarine Industry.

According to *The Board of Trade Journal*, June 13, 1918, the Parliamentary Secretary to the Ministry of Food (the Right Hon. J. R. Clynes, M.P.), speaking in the House of Commons on June 6, stated that the control of oils and fats has become one of the most important and intricate of the duties of the Ministry of Food, and of its trade operations. All important oil seeds, nuts, kernels, vegetable and animal oils and fats, are either purchased by the Ministry abroad, or they are requisitioned on arrival in the United Kingdom. Between twenty and thirty different raw materials are involved under the head of oils and fats, and of margarine. The most important finished product is, of course, margarine. As many as twelve different branches of industry are affected in one way or another, and each has its representative association or committee to assist the Ministry in the allocation and distribution of the raw materials, and of the semi-manufactured articles. It is really a striking development of the Ministry's activities that the increase in margarine manufacture in this country has been so considerable. The productive capacity of the margarine industry has increased fourfold during the War, and this country is now entirely independent of foreign imports. Imports from the Netherlands supplied more than half the consumption of the country in pre-war days, and in the last two months these imports have entirely ceased because the country no longer needed them.

Cyclones of August 22, 1918

On August 22, the weather conditions throughout the whole West Indian region from Antigua to Barbados were so disturbed as to cause some uneasiness, and about midday the wind blew with such force in Barbados as to occasion a considerable amount of damage to small and fragile cottages, and in some instances trees of considerable size were damaged or even uprooted.

An examination of the information obtained through the courtesy of the West Indian and Panama Telegraph Company, and from reports subsequently received from the several islands, makes it clear that there were simultaneously two centres of disturbance. The one most noticeable in its effects was that which appeared to form near to and to the south-east of Barbados, the centre of which passed on the south side of that island soon after 11 a.m. of the day in question. It appears to have passed over the north end of St. Vincent about 4 p.m., where the wind blew with some considerable force, but not with hurricane violence, and no serious damage is reported.

At present there is no information to hand to show what the subsequent course of this cyclone was.

The second of the cyclonic centres referred to, appears to have been central at 4 p.m. over some point between Antigua and Dominica. This cyclone had not then developed as much violence as the one passing near Barbados and St. Vincent. In this case no re-

information has yet been received to show what was the subsequent course and history of this disturbance.

The evidence of the existence of the two centres is clear from the information obtained from the Telegraph Company as to the conditions prevailing at [illegible] as follows:—

Antigua—wind NE, gusty.
Dominica—wind SE, squally.
St. Lucia—wind ENE.
St. Vincent—wind W, squally.

The simultaneous appearance of two centres of disturbance seems to be a common feature of West Indian cyclones: a similar instance was recorded in connexion with the disturbances occurring on October 15, 1916, in the Virgin Islands. (See *Agricultural News*, Vol. XV, p. 355.)

It is well for observers, particularly captains of steamships, to be on the look out for the existence of more than one centre of disturbance. Unless these are recognized it is difficult to locate the centres from observations of the wind directions, for it may be that the observer may have evidence of winds arising from opposite sides of two centres of rotation, and it may be difficult to interpret the facts. This condition is quite likely to happen in the case of a rapidly moving steamship which may pass into both the areas of disturbance.

Hurricane in the Cayman Islands, 1916-17.

The Report on the Blue Book of the Cayman Islands for 1916-17 is published as *Colonial Reports—Annual*, No. 959. In addition to the financial and other data usually presented in reports of this description, this contains an account of a severe hurricane which visited Grand Cayman on September 24, 1917. The most serious feature of the storm was the complete destruction of all provision grounds: very few fruit and breadfruit trees were left standing. Breadfruit had been the mainstay of the poorer classes owing to the high price of foodstuffs, and it can well be realized how serious their position has been. Unfortunately two lives were lost. All the available vessels in Grand Cayman—fourteen in number—were driven ashore, thus adding to the difficulty of communication with Jamaica. Fortunately but a few days elapsed before a schooner arrived from the turtle-fishing grounds of Nicaragua which proceeded to Montego Bay with mails. A supply of foodstuffs was sent down as quickly as possible by His Excellency the Acting Governor of Jamaica. In the meantime a relief committee was appointed to distribute supplies, and everything possible was done to alleviate suffering and distress. Approximately one hundred houses were demolished beyond all hope of repair, and a grant of money was given to those most deserving of help to enable them to rebuild. The east end district of the island sustained the most damage: about sixty houses were blown down in this portion of the Dependency. Very little Government property was destroyed, and the roads, though strewn with debris, were left intact. Relief work on the roads was immediately begun, thus rendering it possible for those willing to work to purchase food, while the steps taken by owners in saving schooners driven ashore, involving an expenditure of some hundreds of pounds, provided labour for a large number of unemployed men.

Treatment for Scaly Leg in Fowls.

The following should be of interest to poultry keepers in the West Indies, where scaly leg is fairly prevalent. The account of the cause of this affection and the recommendations for treatment are taken from the Annual Report on the Department of Agriculture, Fiji, for the year 1916.

Acarina.—A request for information regarding scaly leg or scabies of the legs of poultry, was received during the year, and as the subject may be of general interest to those who keep poultry, the following notes are included in this report. This disease is caused by a mite, *Sarcoptes mutans*, which lives under the epidermal scales covering part of the legs and digits causing irritation which, if untreated, may affect the general health of the birds. The fowls lose condition, cease laying, and lose appetite, and sometimes succumb to the effects of the affection. Although it often happens that some fowls remain healthy for long periods in spite of the cohabitation of healthy with diseased birds, it must be remembered that the disease is highly contagious so that the first step towards eradicating the disease should be the isolation of affected individuals. The hen-house and all parts thereof should be thoroughly disinfected by scrubbing with some standard disinfectant in boiling water. The crusts should be removed from the legs of the fowls and means taken to prevent their reappearance. The crusts are often removed by means of the finger nail or scrubbed off with a brush dipped in tepid water, but this is painful to the bird. The best plan is to soften the crusts by soaking the legs in a tepid alkaline bath for a few minutes and then remove the crusts without causing bleeding. Convenient alkaline baths are lime-water made from calcium carbide refuse [whitelime], washing soda in water, or Scrubb's ammonia in water. When the legs are dry, smear a little of the following ointment, known as 'Helmerich's' pomade:—

	Parts by weight
Sublimed sulphur (flowers of sulphur)	10
Distilled water	5
Almond oil	5
Potassium carbonate	5
Lard	5

This ointment can be made up locally, and for the sum of 2*s.* a sufficient quantity could be obtained to treat many fowls. The ointment may be washed off in two days' time with soap and water, when the legs will be found perfectly clean and free from parasites. It is advisable to smear the cured portion with vaseline for a few days, to allay the irritation which sometimes remains.

INSECT NOTES.

SPREAD OF THE MEXICAN COTTON BOLL WEEVIL IN THE UNITED STATES.

The Mexican boll weevil as a pest of cotton has been the subject of notes in previous numbers of the *Agricultural News*. The most recent of these appeared in the issue for January 27, 1917 (Vol. XVI, p. 23), giving a short account of the spread of this insect during the year 1916.

A circular entitled, 'The Spread of the Cotton Boll Weevil in 1917', by W. D. Hunter and W. D. Pierce, issued by the United States Department of Agriculture, has now been received, which gives an account of the gains and losses in territory by the pest in the year 1917, summarizes the present situation, and reviews the spread of the boll weevil during past years.

It appears that early frosts often kill out the boll weevil, especially in newly invaded territory, so that the gains in one year are offset by losses in the previous winter. Thus in 1917, the total gains in area infested was 12,800 square miles, and the loss 5,500, leaving a net gain of 7,300 square miles.

The total area in the United States infested by the boll weevil at the end of 1917 was 488,240 square miles, and there was an area of only 121,300 square miles in the cotton belt still to be infested. These figures do not take into account the presence of a form of the boll weevil infesting a wild cotton, *Thurberia thespedioides*, in the mountains of Arizona.

The points of great interest to cotton growers in the West Indies are, that for a period of twenty-five years the Mexican boll weevil has spread steadily through the cotton belt of the Southern States at an average rate of more than 15,000 square miles each year, that the Sea Island cotton districts of Georgia and Florida were invaded, and that the pest had reached South Carolina and threatened the Sea Island cotton district of that State at the end of 1917.

Half of Georgia was infested, and the whole of the cotton-growing area of Florida may be considered to be permanently infested. The extension of the weevil in Florida is beyond the limits of cotton growing in previous years. The extension of cotton growing in Florida was due to the effort to find uninfested territory, but the weevil followed closely upon this extension.

The history of the boll weevil in those States growing Sea Island cotton is shown by the following table:—

State.	Year first infested.	Area infested in 1916.	Area infested in 1917.
Georgia	1915	44,400	44,500
Florida	1916	20,300	26,000
South Carolina	1917	—	300

It will be seen from this table that in Florida during the five years from its infestation to the end of the year 1916, 20,300 square miles of territory had been occupied by the pest, and that an additional area of 5,700 square miles was invaded during 1917. In Georgia, 44,400 square miles were infested in the first year of the pest's invasion into that State, the additional 100 square miles recorded in 1917 being the difference between a gain of 1,900 square miles, and a loss of 1,800 square miles in that year.

The bearing of this information on the Sea Island cotton industry in the West Indies is fairly obvious. The output of Sea Island cotton from Georgia, Florida, and South Carolina is bound to suffer reduction, and it is a question whether, in the face of the high cost of production, growers of this class of cotton will not turn to some more profitable crop to take its place

In the event of this happening, the West Indian cotton growers will be in an increasingly strong position; the demand for their product will be greater than formerly, and the price is likely to be higher. It is therefore more than ever incumbent on the West Indian planters and all interested in the welfare of the cotton industry in these islands to protect it by every means. This is now a matter of national importance.

Every precaution should be exercised to prevent the introduction of insect pests not already known to occur in the West Indies, of which the Mexican boll weevil and the pink bollworm are the most important at the present time. Strenuous efforts are needed to control the pests which do occur and are well recognized. Most of these are now capable of being dealt with, either by direct remedial measures, or by cultural measures regulating the time of planting, as in the case of the flower-bud maggot in Antigua; the early removal and destruction of the old plants after the crop is off, and the strict enforcement of a close season, as in the case of the leaf-blister mite and cotton stainers; and the destruction of the wild food-plants, as in the case of the cotton stainers.

The cotton pests of the West Indies are at the present time well known, and the methods of controlling them are understood by cotton planters and agricultural officers. For the most part this control consists of the carrying out of remedial measures and the application of agricultural practices which are generally understood and provided for. Additional legislation is needed in certain instances, however, to facilitate matters.

It must be remembered that the boll weevil has within a period of twenty-five years spread over an area of nearly 500,000 square miles, and in a few years more will occupy the whole of the cotton belt, an area of something like 600,000 square miles.

This steady spread has been in the face of the most careful study and strenuous exertion on the part of the officials of the United States Department of Agriculture, the Officers of the State Experiment Stations and Agricultural Colleges, and of the planters as well, and no means have been devised or discovered to prevent it.

The pink bollworm which has made such extraordinary progress in the past few years is also a pest difficult of control, and probably impossible of eradication under any but the most exceptional conditions in any district where it has become established.

This insect now occurs, in addition to its Asiatic, Egyptian, and African distribution, in Brazil and Mexico, and has even made its appearance in Texas. With regard to the latter locality it cannot be said to be established there, and most energetic measures are in force to eradicate it: these may be successful.

The importation of cotton seed into any of these islands from North, South or Central America, or any other place in the West Indies should be considered as dangerous to the cotton industry, because of these two pests, and because there are perhaps other pests which are not recognized at the present time. Such importation is prohibited in most of the West Indian cotton-growing islands.

Everyone interested in the welfare of these islands should aid every effort to maintain the Sea Island cotton industry by helping to enforce the regulations for combating our known cotton pests. The Sea Island cotton industry of the West Indies is now a national asset of value even beyond its pecuniary interest to the cultivators.

H.A.E.

THE MUSCOVY DUCK.

The Muscovy is a domesticated duck which has for years been known to poultry keepers in the West Indies, and especially amongst the peasantry; but it is doubtful whether the rearing of them has ever been seriously undertaken as a business proposition on a commercial basis. In the following article, abstracted from the *Queensland Agricultural Journal*, July 1918, a description of these birds, their habits, and the small expense incurred in rearing them are given, which should be of interest to poultry keepers in these parts, as indicating the financial benefit to be derived from keeping Muscovy ducks:—

Originally, the Muscovy duck—a wild South American duck—was caught and domesticated, and by careful breeding these ducks have been mated up to a very fine standard of perfection.

Their natural colour was black and white, or blue-black and dirty white, but fanciers have created two distinct colours—white or black. The snowy white variety is, however, much more admired for its beautiful white plumage, scarlet face, and pale orange-colour legs, and these are much more acceptable for market purposes on that account. Their flesh is of fine flavour, and in greater proportion on their breast bones than in any others of the duck family, and when in their prime they often turn the scales at 12 to 14 lb.

The Muscovies are noiseless, very docile, good layers, and as sitters, hatchers, and mothers, are excellent. Incubators cannot equal their results as hatchers. They choose and make their own nests, lay, sit and hatch, and owners have absolutely no worry. Being small eaters, upon a free range they can practically feed themselves. That is another point greatly in their favour. Their food consists of over half green stuff—grass, weeds, roots, and other herbage. Therefore, two meals per day and free range make them mature quickly. They commence to lay at between five and six months old, and generally desire to sit after laying from twenty to thirty eggs. Furthermore, Muscovy ducks, from hatching onward, are extremely hardy and seldom ail.

The ducklings are of strong constitution from the shell. They agree very well among themselves, therefore a whole flock can be allowed to range together. Wherever Muscovy ducks are kept, they never cause any annoyance to neighbours, are never alarmed or timid, and it is practically impossible to frighten them. As travellers they make the best, sitting in their coops as contentedly as if in their own pen.

The rapidity with which this variety has leaped into favour is marvellous, and being marketable at an early age, they command a high value. Hotels, restaurant, and boarding-house proprietors favour them because of the high qualities of meat they possess.

They keep far easier than fowls in condition, and are always plump. There is no special season for hatching them, and the ducklings are exceptionally strong at all times, growing and fattening rapidly on any good food.

Duck farmers starting in a small way have three methods of making a beginning. First, hatching with incubators; second, using Muscovy ducks as hatchers and mothers; third, buying day- or week-old ducklings from some reliable breeder. The last plan is recommended as being the most reliable for beginners. Should Muscovy ducks be used, it will be necessary to purchase a pen of birds, and use their eggs, or buy a setting from some reliable breeder. Should it be decided to obtain ducklings, a brooder for rearing them up to three weeks old will be required.

Always feed at regular times, laying stock as well as breeders. Should birds increase in fat, the quantity of food should not be decreased, but add a greater bulk of green stuff. Remove all foods from troughs after twenty minutes to half an hour, so that no sour food remains. If birds are confined in a limited space they are likely to go off their food, consequently the egg yield suffers. As this class of water fowl is easily kept, reared, and quickly sold, a huge profit is assured for an enthusiast in duck farming.

PRESERVING FISH WITHOUT ICE.

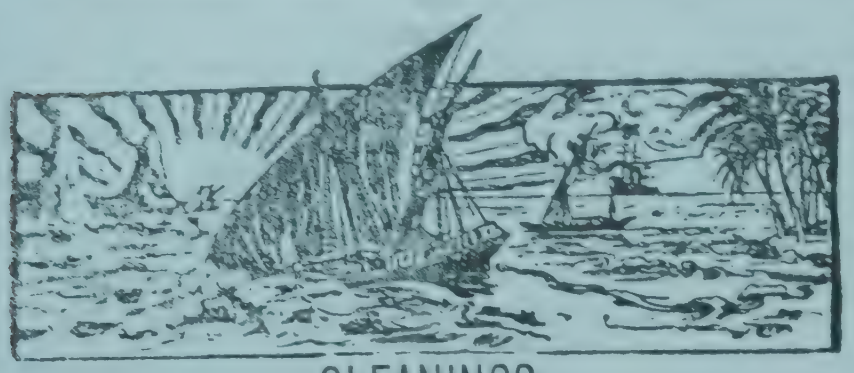
The *Monthly Bulletin of Agricultural Intelligence and Plant Diseases* for June 1918, publishes a method for preserving fish without ice, which compares very favourably with methods hitherto adopted in these West Indian colonies, and seems worthy of trial.

In British Colombia and in England a new method has been adopted for keeping fish. As ice is no longer necessary, the fish can be sold cheaper because the expense incurred through the ice is done away with. The fish keeps its flavour perfectly, and the method may be applied to either fresh or smoked fish, and even to meat.

The whole procedure lasts only three hours. The fish is first placed in a cooling tank containing water at a low temperature. After half an hour the latent heat of the fish has completely disappeared. The fish is then placed in a tank containing sea-water, or fresh water to which salt has been added. To prevent the water from freezing it is stirred with a pump which sends it into a pipe, in which it passes through a filter filled with willow charcoal which kills all bacteria, and then passes out again. The extreme temperature of the salt solution closes the pores of the skin of the fish, prevents saturation, and acts on the exterior as a disinfectant. At the end of three hours the fish is taken out and has the appearance of fresh fish. There is no danger of its going bad for ten days, and it may be kept for months in a cold room. A plant has been set up in Portugal for preserving fresh fish by this method. According to the English engineers who installed the plant, the fish keeps fresh and in excellent condition for about fifteen days, even at a variable temperature. The flavour is that of fresh fish. It does not go soft like fish kept in ice, and may be smoked after having been treated. The method is highly recommended by the Inspector of the Dominion fisheries.

M. A. Cligny, Director of the Marine Station of Boulogne-sur-Mer, France, believes the method to be of the greatest value. It includes two independent parts, the first of which appears the more original, and may be called pre-refrigeration. It is always advisable to wash fish before any freezing procedure, and it would be excellent to wash it in very cold water which would bring it to a temperature of about 0°C. This is an important improvement on the expensive and defective method of covering it with ice or laying it out in cold and relatively large stores for a period of time, which must of necessity be very long. Pre-refrigeration by thorough washing in very cold water could be carried out advantageously in fishing boats. It might be of great importance in the mixed installations, proposed by M. Cligny for fishing boats, in which the use of ice plays its essential part.

The second part of the method consists in freezing the fish previously cooled to 0°C. This second stage may be attained by the use of ice, dry cold, or, as the author proposes, soaking in cold brine.



GLEANINGS.

According to *Colonial Reports*—Annual, No. 959, the turtle trade of the Cayman Islands during 1916-17 was far from satisfactory, the total amount exported being 833 turtles, valued at £1,666. The value of the Islands' exports to all countries amounted to £8,169, as compared with £11,566 in 1915-16.

A cheap fertilizer for growing flowers and vegetables is given in the *Queensland Agricultural Journal*, July 1918, as follows: 'Collect a load of cow dung, not too wet, and make it into a round heap, covering it with a layer of sods. Then set fire to it to char the dung; the charring destroys all seeds. When cool it is fit for use. It must on no account be allowed to get wet before using. If not wanted at once, put it into bags, and keep dry.'

In the January number of *Phytopathology*, L. M. Massey claims that a dust mixture consisting of 90 parts of sulphur, and 10 parts of arsenate of lead is more effective in the control of powdery mildew of roses than a spray of lime-sulphur, and is much less unsightly. The mixture acts both as a fungicide and an insecticide, and is easier to handle than the pure sulphur dust, since the arsenate of lead keeps the sulphur from packing.

The United States Consul-General at Hong Kong reports that quite a fair trade has developed there with the United States in what is known as 'palm fibre' for the manufacture of brushes. The material is the centre of the leaf stem of the small palm (*Livistona chinensis*), which grows wild over much of the South China hill country, and is generally cultivated in some districts for its leaves—the common palm-leaf fan of commerce. (The *Chamber of Commerce Journal*, July 1918.)

The fibre referred to in the above note is obtained by soaking the stem and stripping off the outside portion. The fibre in the stem is then cut into convenient lengths and shipped in bundles of about 200 lb. each. At present it sells wholesale at about 17¼c. local currency per lb. The fibre is used locally, and in fact all over South China, in the manufacture of what are popularly known as 'bamboo brooms', and for Chinese scrubbing brushes and similar articles. It is usually employed in the United States in the manufacture of scrubbing brushes, but is capable of many other uses.

An interesting method of killing weeds in sugar-cane fields in Hawaii, according to the *Queensland Agricultural Journal*, July 1918, consists in spreading over the fields, after the dormant canes have been manured, strips of tarred or asphalted felt paper (weighing 9 lb. to the 100 square feet). The pointed shoots of the young cane grow through the paper which is weighted with stones, and the softer-tipped weeds, failing to penetrate it, are smothered. A similar practice has been employed in England for making lawns.

An article in the *Popular Science Monthly* (New Yor states that the undertaking recently established in Californ for obtaining supplies of potash from seaweeds is proving successful that one firm alone is producing three times much potash as was previously exported from Germany. T kelp is cut by means of a reaper, which cuts the weeds 4 fe below the water. It is stated that sufficient potash is obta ed by these means to supply not only American needs, b also those of all the Allies. (The *Journal of the Departm of Agriculture*, Victoria, May 1918.)

In the *South African Sugar Journal*, May 1918, it stated that there are now eleven sugar factories in operation the island of Formosa, and the production for the 1917 seas reached 451,000 short tons. This sugar was produced vacuum pan and centrifugal processes in the eleven factori When it is recollected that less than a generation ago whole interior of the island of Formosa was occupied untamed savages, and that the sugar industry had only b carried on in a very small way, this development, reachi up to that of the sugar industry in Porto Rico, becon rather startling.

In the report of the Inspector of Schools on Element Education, Trinidad and Tobago, for 1917, it is stated reference to competition in agriculture and nature stu that many of the school gardens have been extend and greater attempts have been made, and with succe to cultivate local provision crops instead of choi vegetables and salads. This is a step in the right dir tion, for although it is useful and instructive to gr exotic foods, it is of much more practical value to children learn first to cultivate their own local foods in a pro manner.

The Department of Botany of the University California has undertaken a study of certain West Americ shrubs belonging to *Chrysothamnus* and other genera of t Compositae, to determine whether or not an emergency supplementary supply of rubber exists in such native plant The investigation is one of the projects of the Botanical su Committee of the Pacific Coast Research Conference, acti under the Council of Defence of the State of California. might be noted here, that the quality of the new rubb exploited, is, according to rubber experts, somewhat bet than the best grades of Guayule, but not as good as Pa (*Science*, May 10, 1918.)

It is estimated in an article on coal saving by the scie tific control of steam-boiler plants, appearing in *Engineeri* for July 12, that 58,500,000 tons of coal per annum are us in England for steam-raising purposes (in normal time exclusive of 15,000,000 tons used in railways. The 250 stea boiler plants operating in Great Britain had a total of 1,0 boilers, principally of the Lancashire type. The autho experience is that, in normal times, the average firm co save 7 to 10 per cent. in the fuel bill alone by buying scientific lines; he estimates that there are 45,000 60,000 steam boilers at work in Great Britai calculated in terms of average size Lancashire boilers, a he considers that all the steam produced in the count to-day could be obtained much more economically wi 25 per cent. fewer boilers. (*Nature*, July 25, 1918.)

THE EFFECT OF ONE GROWING PLANT ON ANOTHER.

From time immemorial gardeners have been convinced that certain plants injure others and, in many cases, it is firmly believed that the harmful effect remains in the soil for months, if not for years. This has led to the opinion that certain plants excrete something from their roots which is poisonous to other plants of the same kind, though not necessarily so to those of a different kind. For a long time the plant was considered as completely analogous to the animal, and, thus the scientist agreed with the practical man in admitting the existence of a poisonous excretion in plants. Of recent years, however, much doubt has been thrown on the idea of a poisonous excretion, and serious obstacles have been shown to hinder its acceptance. In a good grass field, for example, the plants are as crowded as they can be, yet they show no signs of 'sickness' or poisoning. If the soil oe poor the plants may go hungry, but this may be remedied by applying suitable fertilizers; there is nothing in the appearance of the plants to suggest that any other factor is concerned.

On the other hand, some years ago Dr. Whitney, Chief of the Bureau of Soils of the United States Department of Agriculture, expressed the opinion that plants do excrete a toxic substance which may, however, be precipitated or rendered inactive by fertilizers. Therefore the improvement of plants by fertilizers is due, not only to the food they supply, but also to the above-mentioned action, and perhaps to others as well. Whitney's hypothesis gave rise to much discussion, which led to a great deal of progress being made on the subject.

Dr. E. J. Russell, discussing the subject in a recent issue of *Gardeners' Chronicle* (January 1918), observes that British investigators have usually taken the view that there is no evidence of a persistent toxic excretion. The experiments at Rothamsted seem to bear this out. At the present time the famous Broadbalk field is carrying its 75th successive crop of wheat, and the plants look as well as any on the farm, and better than a good deal of the wheat in the district. The last crop of mangolds was the 42nd; it was well above the average, and has rarely been exceeded during the whole period. Similarly, barley has been grown for fifty-seven years in succession without showing any signs of suffering. Leguminous crops, however, cannot be grown in this way, and, after a short period, fail; they are the only crops which experimental evidence has shown cannot be grown year after year on the same land. Observations show, nevertheless, that other plants also fail in the same way; thus foxglove grown splendidly in the soil of a freshly cleared wood (provided the soil is suitable, e.g, the clay patches on the Downes) but for one year only, not longer. It is also said that flax and onions may fail if grown too often in the same soil. These, however, are all simply observations which, even if exact, may have some other explanation.

The idea that plants excrete poisonous substances has been investigated by Mr. Spencer Pickering. The growth of plants was found to be considerably decreased if they received water which had washed part of the roots of another growing plant. This effect seems to be general; the washings from the roots of mustard check the growth of mustard; those from grass check the growth of fruit trees, and so on. It was possible to establish the important point that these washings lose their poisonous quality very rapidly, so that they do not necessarily affect the soil after plant growth has ceased. These experiments are, therefore, perfectly consistent with those at Rothamsted described above.

Another set of Rothamsted experiments is, however, more difficult to reconcile with Mr. Pickering's result. Dr. Winifred Brenchley grew wheat alone, weeds alone, and wheat mixed with wheat; she observed that when poppy (*Papaver rhoeas*), black bent (*Alopecurus agrestis*), and (*Spergula arvensis*) were grown with wheat they made less growth than when grown alone; on the other hand, wheat made more growth per individual plant. This, of course, does not mean that wheat should always be grown with weeds; the plants would have done better had no weeds been present, but they suffered less from the presence of the weeds than they would have done from an equal number of wheat plants. In these experiments spurry proved more harmful than the other weeds, because by its straggling habit it badly checked the young wheat, which never recovered properly. Charlock and wheat settle down to some sort of equlibrium as neither masters the other.

So far as could be seen; the effect was solely one of competition for food, and it made no difference to the individual wheat whether it competed with another wheat plant or a plant of a completely different order. The whole phenomenon could be explained by the supposition that the number of plants the soil can carry depends on the amount of plant food present in the soil, and the amount of space available for growth; if the food and space are to be divided, each individual will get a smaller share and will, consequently, make less growth than if they were fewer plants present. At first sight these results seem difficult to reconcile with those of Pickering's experiments, which seem to prove that a large number of plants suffer not only from starvation, but also from mutual poisoning, so that growth would be less both individually and collectively than when a smaller number is grown. The apparent disagreement may, however, be explained. In another of Mr. Pickering's experiments, plants grown in plots divided into compartments so that each individual root was kept separate from its neighbour made no better growth than did plants in undivided plots where the roots of the plants mixed freely. Thus, the toxin produced by one individual plant does it as much harm as that produced by its neighbour. Further, Mr. Pickering found, in open soil, that the total growth was the same whatever the number of plants (within certain limits of distance apart), or, in other words, that the weights of the plants were inversely proportioned to the bulk of soil available. This is in full agreement with Dr. Brenchley's results, and may be explained perfectly well, without assuming the existence of a toxin, simply by the fact that the full crop-bearing capacity of the soil has been reached. If, with Mr. Pickering, a toxin is assumed to be present, it must be supposed to be at least as harmful to the plant itself as to any other. This assumption involves possibilities which new experiments should investigate.

Before the war India exported annually 20,000,000 raw and 7,500,000 tanned goatskins. The United Kingdom purchased most of the tanned skins, about half of which were re-exported to the Continent, and about a third of the remainder to America. Of the raw skins 75 per cent. were exported to America, 10 per cent. to England, 7 per cent. to France, 5 per cent. to Holland and Belgium, and an insignificant quantity to Germany. Since the war America takes 85·5 per cent., and English imports have dropped to 8 per cent. (The *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, June 1918.)

PLANT DISEASES.

COCO-NUT BUD-ROT.

In the last number of this Journal, in giving an account of the type of bud-rot commencing in the heart of the tree, now suspected to be comparable with the fungoid bud-rot of the East, brief allusion was made to the alternative type of disease occurring on the outer limbs or fruit-stalks. To complete the account of bud-rot as at present understood, some particulars will now be given, also drawn in the main from the Jamaica descriptions of this form. The affection is believed on good grounds to be of bacterial origin, but the characters of the particular species, believed to be causative by different workers, exhibit somewhat wide diversity.

The attack may begin either on the bases of the leaves or flower spikes, or the tissues between them. It never extends far on the leaf-stalk, nor does it affect the woody part of the stem.

When infection is of this nature, the first sign is commonly the falling of unripe nuts owing to the infestation of the base of the fruit-stalk. The dropping of young nuts is not in itself evidence of bud-rot. It occurs quite commonly when trees are suffering from drought, water-logging, or any cause which affects the ability of the tree to nourish the full number of fruits set. Injury to the base of the spike, such as may be caused by insects or by careless picking, will also cause dropping.

Another early sign of the disease is the discoloration of the flowering spikes, which turn chocolate-brown, and eventually blacken and wither. Investigation at this time reveals a dark-coloured wet rot about the base of the affected parts. The rot works its way through or under the moist strainer, affecting the various organs as it reaches their points of attachment. Water-soaked areas appear on the leaf-stalks, and as the rot progresses the leaves involved turn yellow and hang down. Eventually, though it may be the work of months, the rot reaches to the central column, and the tree is killed.

The usual method by which treatment is attempted to arrest the development of this disease in an infected tree, is the firing of the dry matter in the top, using kerosene if necessary to start a blaze. It is said to be a good plan after firing to spray the whole top with Bordeaux mixture, adding 2 lb. of lead arsenate to each 50 gallons of spray, in order to prevent weevil-damage to the scorched tissues.

W.N.

A NEW SOURCE OF VEGETABLE OIL.

S. H. Parsons and R. F. Heron have described in the *Oil, Paint, and Drug Reporter*, for March 18, what they designate 'a new source of vegetable oil close to United States ports.' The following interesting information concerning this is abstracted from a summary appearing in the *Perfumery and Essential Oil Record*, July 23, 1918.

The suddenly increased demand for vegetable oils has drawn attention to the immense forests of oil-seed bearing palms in Central and South America. For over fifty years the fruits of several of the nut-bearing palms have been exploited as a source of oil in a sporadic and desultory manner. Chief among these are the *Attalea cohune*, of British Honduras, the manaca and coyol of Guatemala and Spanish Honduras, and the coquito of Southern Mexico. At various times writers on the subject have classed the manaca and coquito as the *Attalea cohune*, but a very cursory examination of the habits and fruits of these trees shows such differences that the writers are inclined to consider them of a different species rather than simply a variant of the same species.

THE COHUNE NUT.

The *Attalea cohune* of British Honduras, and the neighbouring territory of Yucatan on the north and Guatemala on the south, does not entirely confine itself to the coast lands, but it is seldom found at a greater altitude than a very few feet above sea-level. The tree grows in dense clumps, usually following along the slight ridges which mark the ancient beach lines.

The cohune, coquito, and manaca trees are very similar in general appearance. The first two have a smoth, greyish trunk, paler where the trunk is exposed to direct sunlight. The manaca has a somewhat more persistently clinging leaf-stalk. Very often the entire trunk of mature trees is hidden by the dead stalks. The coyol differs considerably in its appearance, both in leaf and trunk. The trunk of this tree seldom, if ever, is found clean and smooth.

While the cohune, manaca, and coquito leaves are perfectly regular, having equal and opposite leaflets, the coyol is easily distinguished by its somewhat more ragged and irregular leaf, the leaflets being unequal, and irregularly placed on opposite sides of the mid-rib. The fruit of the coyol is smaller and less elongated, being almost round. It is borne in bunches of from 30 to 50 lb. each. Underneath a thin outer husk which covers each nut is found a sweet, oily pulp, somewhat prized by the natives as an edible fruit.

Fruit of Manaca.—The fruit of the manaca is borne in bunches similar to those of the coyol, though usually large in size. These bunches will average from 50 to 60 lb. each, and in some cases will weigh as high as 100 lb. The individual fruits are elongated, measuring from $1\frac{3}{4}$ to 2 inches in length, and about 1 inch through the short diameter. The pericarp of this nut, which is very thin and fragile, is underlaid by a pulp considerably thicker and much softer than is the case with the coyol. Considerable oil is contained in the pericarp and in the pulp. The oil extracted from this pulp approximates very closely the African palm oil of commerce.

The coquito and cohune have considerably less of the fleshy pulp surrounding the shell of the nut, but both of these nuts contain a fair percentage of oil in the husk. Extractable oil to the amount 15 per cent. by weight has been found in both cases. On account of the bulk, and the tough fibrous nature of the outer layer of these nuts, there would be some difficulty in extracting the oil except by solvents. Certain experiments are being made, however, which promise an inexpensive method of recovering this oil.

The present value of the palm nuts is in the kernels. Of the *Attalea cohune*, the kernel is from 8·6 to 13·5 per cent. of the total weight of the dried nut. The usual number of kernels is one to each nut. Probably 30 per cent. of the nuts contain two and sometimes three kernels.

From a comparative analysis of coco-nut oil and cohune oil, it appears that, physically both oils have the same colour and apparent solidity. The faint odour of the unbleached cohune kernel oil greatly resembles that of oil from coco-nuts. Almost no odour can be noted after treatment with animal charcoal. Unless care is taken in the preparation of the oil, especially oil prepared in warm climates, a tendency to rancidity is noticed. This, however, is avoided by the experienced manufacturers.

The greater part of the kernels are extracted by the natives. An industrious native gathers about one-half ton

of nuts per day, and spreads them out on a 'patio', or drying floor, where they remain for several weeks. This drying loosens the kernel from the shell. The native then cracks the nuts. The average man is able to crack and separate the kernels from about 100 to 125lb. of nuts per day This gives about 15 lb. of kernels, for which he is paid approximately 5c. per lb.

Many attempts to improve upon the natives' methods have been made, and many machines have been tried with the object of doing away with the hand cracking. Almost all these experiments have failed. The nut is so hard and so difficult to crack that the ordinary commercial nut cracking machine is useless. Also these machines are usually of a complicated nature, and therefore unfitted for use with the unskilled labour available. Other forms have been tried on the principle of the rock crusher. These machines crack the nut as well as the kernel, instead of only cracking the shell, thereby causing a portion of the oil to be pressed to the surface. In the warm, humid climate of the tropics, fermentation takes place very rapidly, and the oil becomes rancid. Recently a new process has been patented in the United States and foreign countries, which bids fair to solve the problem. The nut as soon as gathered is passed through a rotary husking machine, which removes the outer covering, thus assisting in more rapidly drying the nuts. They are then delivered by a conveyer to a machine which throws the nuts against a breaking plate with a speed of 9,000 feet per minute. This is sufficient to crack the shell of the properly dried nut, but does not crack the nuts that are not yet sufficiently tempered. The broken nut is then passed through a separator, which separates the kernels from the shell. The capacity of a single unit of the plant is about 40 tons of dried nuts per day. The kernels are then put through an ordinary copra drier, and when sacked, are ready for market. Upon arrival in the United States, the kernels are treated to almost identically the same process as coco-nut copra for the extraction of the oil.

UNIVERSITY EMPIRE STUDY.

A letter has been addressed by the Imperial Studies Committee of the Royal Colonial Institute to the universities of the United Kingdom, urging that, under the changed conditions which must be expected after the war, the importance of founding endowments for the adequate teaching of Empire subjects, and in particular the history of the Empire, should be placed in the foreground. Very encouraging replies have been made.

According to *The Times* for June 28, the following resolutions of the Committee indicate their view as to the best methods of promoting Empire study at the universities:—

'In every university in the Mother Country, the Dominions, and Dependencies, there should be a chair of colonial and Imperial history, with adequate salaries to the professor and staff.

2. 'In all universities there should be adequate arrangements, including specialized libraries and properly endowed studentships, for post graduate work in colonial and Imperial history.

3. 'In such universities there should also be a chair of the history and organization of commerce.

4. 'Professors of the above subjects should once at least in each complete period of seven years be allowed one year's period of special leave on full salary, that they may travel to investigate and report on the prevailing conditions of trade and industry, the natural resources, methods of administration, and progressive organization and development of the different parts of the Empire.

5. 'During such period of special leave, the professors concerned should have facilities afforded for conference with the staffs of the universities visited, for delivering lectures in such universities, and addresses to the general public. Suitable travelling allowances should be made, and each such professor should be accredited by his own State and university.

6. 'The system of travelling fellowships should be completely organized and greatly extended throughout the entire Empire.

7. 'Reports by professors under paragraph 4, and the research work of post-graduates under paragraph 5, should be published in appropriate form, and widely circulated.

8. 'Specimens and samples of the staple products of the Empire, reports as to conditions and prospects of trade, the extent of natural resources, photographs, and films illustrating the customs and habits of native races should, by arrangement with the proper authorities, be supplied to all universities.

9. 'Each university should, within its area or sphere of influence, arrange with the local education authorities for a series of extension lectures and addresses on the problems of the Empire and its administration.'

SCIENTIFIC RESEARCH IN AGRICULTURE.

The President of the Board of Agriculture (Mr. R. E. Prothero), in the House of Commons on July 18, reviewed the operations of his department during the past twelve months. After alluding to the work of Professor Russell at Rothamsted, in connexion with the turning of grass land into arable, and the production of an effective insecticide, and of Professors Wood and Hopkins at Cambridge, on animal nutrition, he illustrated the possibilities of scientific research in agriculture from Professor Biffen's well-known plant-breeding investigations. He pointed out that, after examining a number of varieties of foreign wheat, Professor Biffen discovered a Russian wheat called ghirka, which resists rust. Now rust destroys annually thousands of quarters of wheat, but this ghirka wheat was of no use to the British farmer because its yield was miserably low. But Professor Biffen, by using the Mendel system, was able to transfer the rust-resisting quality of ghirka to a high-yielding English wheat, and though that wheat has now been in use for several years, it has shown no tendency whatever to revert either to the rust tendency of one parent, or the low-yielding tendency of the other. He has now produced a wheat which produces a high quality of straw—a fine, stiff, upstanding straw—and a high quality of yield of grain, so much so that without pushing it will produce 42 bushels to the acre, and by pushing, up to 72 bushels to the acre. It also possesses a very high quality of disease resistance, which is so highly valued by both millers and bakers, and which is recognized in increased prices.

Mr. Prothero added: 'Hitherto the plant-breeding work has been hardly applied to any of the crops of the farmer except wheat—though it has been applied to barley—and mainly to wheat suitable to the Eastern Counties. But suppose you apply it to the wheats and barleys used in other districts, to oats and rye, to temporary grass and potatoes. There is an extraordinary list of possibilities opened to the British farmer. If, for instance, you could produce a potato which was immune from blight, and immune from wart disease, it would be an invaluable boon to English agriculturists, and there is every prospect that that may be achieved.' (The *Journal of the Royal Society of Arts*, August 9, 1918.)

MARKET REPORTS.

London.—The West India Committee Circular, August 22.

Arrowroot—No quotations.
Balata—Venezuelan Block, no quotations; Sheet, no quotations.
Beeswax—No quotations.
Cacao—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 4/6 to 5/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—9½*d*.
Rubber—Para, fine hard, 3/0½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., July 27

Cacao—Venezuelan, $11·10; Trinidad, $11·75 to $12·40.
Coco-nut Oil—$1·16 per gallon.
Coffee—Venezuelan, no quotations.
Copra—$6·25 per 100 lb.
Dhal—No quotations.
Onions—$4·00 per 100 lb.
Peas, Split—$8·00 per bag.
Potatoes—English, $5·00 per 100 lb.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., July 12.

Cacao—Caracas, 13c; Grenada, 13c.; Trinidad, 12¾c. to 13c.; Jamaica, 11½c. to 12c.
Coco-nuts—Jamaica selects, $42·00; Trinidad $40·00; culls, $20·00 to $21·00 per M.
Coffee—Jamaica, 9½c. to 11c. per lb.
Ginger—15½c. to 16½c. per lb.
Goat Skins—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per lb
Grape Fruit—Jamaica, importation prohibited.
Limes—Importation prohibited.
Mace—40c. to 45c. per lb.
Nutmegs—27c.
Oranges—Importation prohibited.
Pimento—6¾c. to 7c. per lb.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·055c. Molasses, 89°, 4·998c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., August 29.

Arrowroot—$12·00 per 100 lb.
Cacao—$12·00 to $12·50 per 100 lb.
Coco-nuts—$48·00 husked nuts.
Hay—$3·00.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations, Rangoor, no quotations.
Sugar—Dark Crystals, $5·00.

Publications on sale of the Imperial Department of Agriculture.

The 'WEST INDIAN BULLETIN': A Quarterly Scientific Journal.

Volume XVII, No. 1. Containing Papers on Insects attacking Cotton Bolls, and a Paper on Fish Poisoning.

HANDBOOK AND PAMPHLET SERIES.

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The 'AGRICULTURAL NEWS': A Fortnightly Review.

The '**Agricultural News**' contains extracts from official correspondence, and from progress and other reports; and, in fact, any information indicating what is going on in each colony, and the progress made in agricultural matters throughout the West Indies.

The '**Agricultural News**' is printed in time to be distributed regularly by each mail, and is on sale by the local agents of the Department at one penny per number, post free 1½*d*. The subscription price, including postage, is 2*s*. 2*d*. per half-year, or 3*s*. 3*d*. per annum. Volumes VIII to XVI complete, with title page and index, as issued—Price 4*s*. each—post free, 5*s*. The scale of charges for Advertisements may be obtained on application to the Agents.

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West India Committee, 15, Seething Lane.
Barbados: Advocate Co. Ltd., Broad Street, Bridgetown.
Jamaica: The Educational Supply Company, 16, King Street, Kingston.
British Guiana: The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. H. G. Christie, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George.
St. Vincent: Mr. J. D. Bonadie, 'Times' Office.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau.
Montserrat: Mr. W. Robson, Botanic Station.
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 81, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

VOL. XVII. No. 429. BARBADOS, OCTOBER 5, 1918. PRICE 1d.

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Influence of Records on Development.

ONE of the most striking ways in which the agriculture of the present differs from that of the past, and in which the agriculture of the future will differ even more strikingly from that of the present, is the extent to which dependence is placed upon, and advancement conditioned by, the use of written records. In the past, agriculture the world over has built up a body of tradition which served to guide its work, and which slowly made for progress. The industry was, to a large extent, self-contained. In late years, however, the increased intercourse between farmers, and the large amount of special literature have caused the farming world to be more and more invaded from outside. New ideas have been thrust upon farmers, some of which, taking hold, have been found to be of service and have been adopted, while others have been sought or tendered, and as a result, the trend of events has been towards intellectual change, often amounting to revolution, and consequently, farming the world over no longer remains an isolated industry to be carried on in a leisurely way by men who come only remotely into contact with the world's affairs.

The increased and increasing facilities for intercourse between places within the same region, and also between widely separated countries, have done much to introduce and foster the new spirit, partly by making exchange of ideas more readily possible, but even more by creating competition between the farmers of widely separated regions. Men have been urged to make their living under new conditions, and have striven to increase their wealth in new surroundings, and thus have brought into the world's markets vast and unexpected quantities of farm products which have profoundly affected the welfare, and the modes of life and thought of most distant places. In this way, the farmers of the United Kingdom have been profoundly affected by the developments on the American prairies, and by the wheat fields of the Canadian West. At the same time they have felt the competition of New Zealand mutton and Argentine beef.

Instances might be multiplied almost indefinitely, and illustrations might be taken nearer home, if one

were to enquire concerning the changes which have taken place in West Indian agriculture since the days when the early settlers cultivated tobacco, indigo, and ginger as their staple crops; and if one thought of the changes leading to the growth and decline, followed by the present revival of the sugar industry, or the development of such industries as the cultivation of cacao, bananas, and coco-nuts. In all of these can be traced the effect of competition and the bringing in of new ideas from outside for the stirring up and encouragement of planters.

As already stated, when these changes are looked at, the great effect of the written record becomes more and more apparent. In the older countries, and in the early days, the forward movement was largely influenced, as regards its written records, by Agricultural Societies, Farmers' Institutes, and kindred organizations. It was soon found that there were important fields of knowledge which appeared attractive, and promised to be profitable; but the busily occupied farmers, having little experience of things lying outside their daily duties, were unable to deal with these to advantage; so the aid of specialist enquirers and investigators was invoked and welcomed. This, in turn, led to the recognition of yet wider and wider fields of knowledge, but at the same time deepened the conviction that the exploration of these fields to advantage necessitated the employment of special investigators. Hence there grew up a body of scientific men, not themselves farmers, and often having but an imperfect appreciation of the business of farming as a whole; but who were able to investigate special portions of farming problems, and to put forward ideas and conclusions which the farmers themselves were able to weave into their daily practice.

These conditions in turn reacted more widely; the early specialist investigators, such as Lawes and Liebig, found themselves hampered by their isolation and the extreme imperfection of their knowledge, so that they were often unable to solve the problems confronting them, or found themselves drifting to wrong conclusions owing to their imperfect knowledge. A movement therefore quickly grew up for improving the facilities of investigators, and adding to their knowledge. This took many forms, amongst them the improvement and increase in academic teaching in schools and universities of the sciences bearing on agriculture, and the creation of agricultural departments, such as are now to be found in practically every country in the world, culminating in the wonderful organization to be seen in the United States, with their vast Federal Department with its ever-increasing Divisions, supplemented by important State Departments, each aided by an experiment station for the advancement of knowledge, and in many cases by an agricultural college, often of university rank, for the purpose of inculcating and diffusing that knowledge.

Such a survey makes it evident that agriculture is no longer an isolated pursuit which can be carried on in the light of simple tradition handed down from father to son; it is perhaps the most complex industry of the world. Only since the effects of the present world-war have begun to be seriously felt by the contending nations has it been realized how completely dependent modern States are upon their agriculture, and upon the agriculture of their neighbours. Complete isolation in agricultural matters will quickly bring to stagnation and ruin any State, large or small. The service of agriculture is world-wide, and its modern continuance is conditioned and determined by scientific knowledge.

The written record has made this development possible. In this connexion an idea occurs. It is often said, and more frequently thought, that once an idea is placed on record its effectiveness is secured. This is far from being the case; mere written records are liable to lie dead or dormant, unless they fall on fertile times and places, and appeal to the minds of those who can use them. This may seem a mere truism, and it may be so, but it is a fact which profoundly affects progress. The extraordinary instance of Mendel's work, the record of which lay enshrined, dormant and inoperative, for thirty-five years, from 1865 to 1900, in the archives of the Natural History Society of Brunn, is a case in point. For the whole of that time this work was practically unknown and entirely useless, but when the attention of modern botanists was directed to it, and it was carefully investigated, it became of the greatest value, and exercised startling influence in the development of many modern agricultural problems.

It is necessary in every country, including our small West Indian communities, to make provision for the means of keeping alive, and bringing into prominence from time to time, the ideas contained in the written records of our own and other countries. This forms one of the most important, but perhaps little-recognized functions of the officers of our Agricultural Departments. One of their duties is the carrying on of work and experiments directed towards the improvement of agricultural methods, the introduction of

new crops and new plants, and generally, to be vigilant in noting what is passing in the agricultural world, in order to seize upon it for local application, where such a bearing is possible. At frequent intervals they put forward in reports and papers, accounts of their work in this connexion, and the information thus accumulated appears to be ready and available for the use of the planter whom it may concern. Much of this work, thus recorded, would pass with little recognition, unless these officers themselves pointed to the possible applications of what they have recorded, and pointed to it frequently: for often information fails to strike the busy man as applicable to himself or to his own concerns, from the fact that at the moment when the information comes under his notice his thoughts are centred on other things, and later he forgets the information, and fails to make the application. Thus an important part of the work of agricultural officers lies in keeping alive the knowledge that is available, and producing it for use when occasion requires.

At times, too great reliance is placed on this function of the agricultural officers and planters, and others relegate the whole duty of pointing out the path of progress to these men, instead of themselves maintaining a lively interest in current events. As a result, the work of the agricultural societies, the bodies which should form the Planters' Parliaments, frequently languishes, and the records show that such vitality as they possess often depends on the efforts and activities of the agricultural officers, instead of upon those of the planters, for whose benefit these institutions ostensibly exist. A striking instance of waning activity in this direction was referred to in the editorial in the last issue of this Journal, as brought into prominence in the Presidential Address of Professor Harrison to the Royal Agricultural and Commercial Society of British Guiana. Parallel instances may be found in the records of the majority of West Indian agricultural societies.

By way of summary it may well be urged that while the written record is essential for progress, it must be added that this is of no avail without live men to interpret and apply it.

DEPARTMENT NEWS.

Mr. W. Novell, D.I.C., Mycologist on the staff of the Imperial Department of Agriculture, returned to Barbados on September 27, after a short visit to Dominica and Montserrat in connexion with investigation of certain plant diseases.

CURING MEAT IN HOT WEATHER.

The following recipes for curing meat in hot weather are reproduced from the Queensland *Agricultural Journal*, for June 1918, as likely to be useful to readers of the *Agricultural News*. In this connexion, reference might also be made to a successful experiment in salting pork, carried out by Mr. C. P. Stoute, then Government Veterinary Officer of St. Vincent, *vide Agricultural News*, Vol. XV, p. 159:—

Recipes for curing meat in hot weather are of special interest, and the ones given here have been tried. Meat for curing must be thoroughly cooled, because if the surface of meat comes in contact with salt before all the animal heat is removed, it will have a tendency to shrink the muscles, and form a coating on the outside which will not allow the generating gases to escape.

Good brine for brine-curing can be made from 10 lb. of salt, 2 lb. of sugar or molasses, and 4 gallons of water to 100 lb. of meat. It is a good precaution to boil and skim the mixture. Two or 3 oz. of saltpetre may be added to preserve the natural colour of the meat, but is harmful to the health even if used in small quantities. Meat cures more rapidly if the brine does not become too cold. Bacon will cure in from twenty-two to thirty days, while heavier hams need from forty to sixty days. Freshen cured meat in lukewarm water for six hours, then dry and smoke.

For dry curing, make a mixture of clean, fine salt, 40 lb.; white or brown sugar, 10 lb.; white or black pepper, 4 lb.; red pepper, ½ lb. This will make enough mixture for about 1,000 lb. of pork. If saltpetre is desired, use 2 lb. in the above mixture. Rub each piece of meat thoroughly with the mixture, working it in well around the bones of hams and shoulders. Pack with skin down, in a cool, airy place, not in direct sunlight, nor in a damp musty cellar. After four or five days overhaul the meat, rub thoroughly with the mixture, and repack; repeat this in about a week. Hams and shoulders should remain in the mixture from one and a half to two days per pound weight apiece; the latter time is safer for meat that is to be kept during the summer. Bacon should be in the mixture a shorter time. Ten days will give a very nice mild cure to a 6 or 8 lb. piece.

Any of the mixtures which give good results in curing pork can be used satisfactorily for beef, but beef should not be allowed to remain in the brine or mixture quite so long. Corned beef is best when it has been in the mixture about ten days.

Get the tender side of the round of good fat beef. For every 20 lb. of beef take 1 pint of salt, a teaspoonful of saltpetre, and a ¼ lb of brown sugar. Mix these well, rolling out any lumps; divide into three equal parts, and rub well into the beef for three successive days. Turn the beef daily in the liquor it will make. It should not make much, but what there is rub well into, and pile on the beef. Rub a little extra salt into the hole cut for the string to hang it by. At the end of a week hang the beef in a dry, rather warm place, till it stops dripping, then in a cooler, dry place. Do not smoke it; smoking spoils the flavour.

Sometimes there is trouble in keeping meat after it has been cured or smoked. It should be stored in a dry, cool, and well-ventilated place. The most satisfactory way to handle such meat is to wrap it up in paper, and then enclose it in strong muslin sacks tied tightly at the tops.

SUGAR FACTORY CONTROL.

In an article in the August issue of the *International Sugar Journal*, Mr. Frank Coxon, writing under the heading, 'Sugar Factory Control, a neglected duty of the home administrations', points out that sugar factory reports and control sheets, when sent to the Head Office of the various concerns, seldom receive the critical consideration which they deserve, and are seldom used to make the necessary comparisons for appreciating the correct position of the reporting factories as regards the excellence or the defects of their work. This he thinks is partly due to the multiplicity of the matters commonly dealt with in the sheets, and partly to the lack of detailed technical knowledge on the part of those to whom they are submitted. He suggests that these difficulties might be minimized, and the information made readily accessible even to those having but slight technical training, if steps were taken to abstract from the lengthy main reports of the factories, the principal figures on which the working of a factory may be judged. He mentions some of the salient items.

He further suggests that the information contained in these abstracts will find more ready application in the managing offices if comparisons are continuously made between the figures so recorded for any company's factory, and the similar figures collated in respect of various other factories, so as to enable comparisons to be made at once, and with the minimum of effort.

Instances are given of such abstracted reports, and of the comparisons which may be readily drawn from them without abstruse calculation of any marked technical knowledge.

We need hardly remind our readers that this method of working has been made free use of in the case of the pioneer central sugar factories at Antigua and St. Kitts, abstracts from the working-sheets of which, and deductions drawn therefrom, have frequently appeared in the publications of this Department, the Directors of these factories holding that it is to the general advantage of the West Indian sugar industry as a whole thus to circulate knowledge. It may be added that this advantage might be widened, if the Directors of other concerns were to adopt a similar policy, and to put forward the main features of their factory control sheets for the information of their colleagues.

It may be unnecessary to refer to the very full and valuable information along these lines which is regularly furnished by the great sugar-producing countries, such as Java, Hawaii, and others. These instances afford precedents which might well be followed to a greater extent than at present by our British West Indian factory owners.

RICE CULTIVATION IN BRITISH GUIANA.

In continuation of observations in the last issue of this Journal with reference to the Presidential Address of Professor Harrison, C.M.G., M.A., to the Royal Agricultural and Commercial Society, British Guiana, the following particulars regarding the progress of the rice industry of that Colony since 1884 are appended:—

Among the most striking, if not the most striking, of the agricultural developments in the West Indian Province during the twenty-one years which have elapsed since 1897 has been the very extensive rice industry of British Guiana. In 1897 one of the most important steps ever taken with regard to that industry was completed by the erection, by the aid of a Government loan, of the pioneer large-scale rice factory in Georgetown. In the Report of the West Indian Royal Commission issued towards the end of 1897, was the following:—

'Rice to the value of £180,000 was imported in 1895-6 for consumption in the Colony. Rice of excellent quality is already grown in British Guiana, and every effort should be made to produce locally all that is wanted of this article.'

Whilst in the Dr. Morris's Subsidiary Report was the following:—

'There can be no doubt as to the decided opinion which prevails that rice growing is a most promising industry on the coast lands of British Guiana. The cultivation so far has been undertaken on comparatively small areas by coolies, and with very crude appliances for threshing and husking the grain. Recently a loan has been sanctioned by the Government for erecting and working one or more rice factories where the rice could be milled and prepared at a small cost for local consumption. The present cost of husking rice by hand-pounding in mortars is estimated at 3*s.* 6*d.* per bag. At well-equipped mills this could be done at a cost of about 1*s.* 6*d.* per bag. It is confidently anticipated that as soon as mills are established a great impetus will be given to rice growing all over the colony.'

The progress of the rice industry since 1884 is shown in the following statement:—

QUINQUENNIAL PERIODS.

Periods.	No. of acres, British, reaped.	Rice exported, lb. per annum.	Rice imported, lb. per annum.
1884-88	(about) 2,500	nil	43,500,000
1889-93	,, 2,500	,,	41,964,000
1894-98	,, 7,490	10,820	32,062,000
1896	*6,500*	*nil*	*32,913,000*
1899-1903	,, 15,020	6,000	18,127,000
1904-8	,, 29,500	3,769,000	5,644,000
1909-13	,, 37,750	10,177,000	355,000
1914, 1915 and 1916 (3 years only)	50,270	21,769,300	20,100
1917	*63,580*	*32,182,000*	*nil*

The statement verifies in a most striking manner the views of the Royal Commission and of their able colleague and adviser, Sir Daniel Morris; 32,000,000 lb. imported in 1896; 32,000,000 exported in 1917.

The area under rice cultivation in 1896-7 was about 6,500 British acres, yielding paddy equal to about 4,000 tons of cleaned rice, in value about £48,000 or $230,000, whilst in 1917 not less than 63,580 acres were reaped, yielding paddy equal to about 45,000 tons of commercial rice, having a value in normal times of at least £540,000 or $2,600,000

The yields of rice in the colony vary very greatly: for instance, on empoldered lands with satisfactory facilities for irrigation and drainage, the crops may be from 20 to 28 bags (of 140-150 lb.) of paddy, the average yields on these lands being 25 bags per acre; on non-empoldered lands with fair irrigation, the yields are from 16 to 20 bags of paddy per acre, whilst on poor and unsuitable lands with defective irrigation, or with no means of irrigation, and dependent solely on the rainfall, the yields are only from 8 to 14 bags per acre. Over the whole colony the average yields are from 18 to 23 bags per acre per crop, the yields being governed by the characteristics of the seasons.

In some districts, more especially in North-East Essequebo, where facilities for irrigation and drainage are exceptionally favourable, two crops per annum are usually reaped.

from 38 to 45 bags (of 140 lb.) of paddy per acre, whilst on non-empoldered lands the total annual yields are from 30 to 35 bags.

Prior to 1897 several attempts were made, with but little success, towards improving the quality and yield of rice in British Guiana, by importing seed-paddy from Calcutta. They were resumed in 1897, but failed, as at that time the Botanic Gardens proper were used almost exclusively for ornamental and horticultural purposes, whilst there was not any land available in the experimental section devoted to sugar-cane. In 1902, with the assistance of the late Sir Alexander Ashmore, some marsh paddies of choice varieties were obtained from Ceylon. An area of then practically marsh land in the north-eastern section of the Botanic Gardens was cleared from bush, and laid out in rice beds under the direction of Mr. Gainfort, whilst acting as Superintendent of the Gardens. A year later, supplies of hill paddy were obtained, but owing to 'heating' on the voyage from Ceylon here, the seed-paddy proved almost entirely non-fertile; Mr. E. Ward, however, succeeded in germinating nine grains of the paddies, and from them some good strains of hill-rice were obtained. Later supplies of seed-paddy have been obtained from several different countries and colonies, and over 300 varieties have been under experimental field trial. Few of them have been able to compete in yield and quality of paddy with the Creole rice of British Guiana as improved by careful and continuous seed and field selection. On these fields the yields of the Creole rice have increased from 35 cwt. per acre in 1905 to 42 cwt. in 1916, and to 41 cwt. in 1917. The best of the introduced varieties now only yields, on the average, about 1½ cwt. of paddy per acre more than does the Creole, whilst its former excess yields over the local kinds were from 3 to 4 cwt. per acre per crop.

From 10 to 12 tons of seed-paddy, 99 per cent. true to type, of the best imported and local strains have been distributed from the Botanic Gardens among rice planters each year since 1907.

The average yields of rice per acre in British Guiana are fairly satisfactory, but the following table shows that, whilst the colony occupies an enviable position among rice-producing countries with regard to this, a few others far exceed it, and it is to their standards that rice growers in this colony should strive to attain:—

	Cleaned rice, cwt. per acre.
Spain	26·0
Egypt	21·5
Japan	21·5
British Guiana	15·0 to 19·0
(Empoldered lands	16·0 to 22·0
(Other lands	11·0 to 16·0
Italy	16·7
Formosa	15·0 to 17·0
Korea	11·0 to 12·0
Java	11·0
United States	8·6 to 12·0
Borneo	8·4
British India	7·3 to 8·6
Malaya	7·3
Trinidad	7·0
North Borneo	6·3
Ceylon	4·4 to 5·6
Philippine Islands	4·0 to 5·0

Our high yields may be due in part to the excellence of our local strains of rice, and in part to our facilities for irrigation; but not in the same degree to excellence of cultivation. When it becomes feasible to cultivate the rice lands more thoroughly, the yield should increase to a considerable extent. We are favoured here in many places by the special suitability of savannah and creek-waters for the irrigation of the rice fields, the high content of plant food in the waters enabling the lands irrigated with them to produce heavy crops of rice year after year without showing any signs of falling-off in yield. Abandoned sugar-cane lands are especially suitable for rice cultivation, owing to the impervious clay-pans which have formed in them at about 12 inches from their surfaces, and which tend to conserve the irrigation-water from loss by seepage; and to the marked stimulus to the growth of the rice by the saline matter which has accumulated in the lower layers of their soils. Rain-water does not result in such heavy returns of rice as does irrigation with creek-water; whilst the yields from using artesian well-water may be even lower than from rain. Our trials during recent years have proved that artesian well-water must be applied to the land in a continuous flow, and not intermittently, as swamp or creek-water is used. Where artesian water is employed, the need of repeated tillage between the succeeding crops becomes very marked; our trials show that an additional thorough ploughing may increase the yields from 4 to 9 cwt. of paddy per acre.

It is possible to get five crops of rice in two years by using continuously flowing artesian well-water, the total yield of paddy thus obtained in our trials being 166 cwt. per acre, or at the rate of 33½ cwt. per crop, or 83 cwt. per annum. During the same period two crops of rice were obtained on similar land using creek-water which together weighed 87 cwt. Thus, although the crops obtained through the use of artesian water are not individually as high as those obtainable by the use of creek-water, the total yields obtained by constant cropping may be much the greater.

I am satisfied that by using artesian well-water with thorough tillage between the crops, four crops of rice can be obtained in two years, weighing from 130 to 150 cwt., which yield would compare very favourably with the crops obtained by the double cropping system with creek-water in North-East Essequebo, where an average yield of about 96 cwt., and a maximum one of 120 cwt. are obtained.

There are still vast areas of potential rice lands available on the front lands of the colony, and I think we may look forward with confidence to a time in the near future when we shall have, say, 100,000 acres cropped with paddy, yielding from 75,000 to 80,000 tons of cleaned rice per annum.

It is usual to ascribe the success of the rice industry solely to the East Indian section of the community. This is not strictly correct: its initiation was due to negro colonists; its early devolopment on a small scale was due to the unaided efforts of the East Indians; its greater devolopment has been due to the manner in which rice millers and local capitalists have co-operated with, and financially aided the East Indians in building up the industry on commercial lines.

I alluded earlier in this address to the great impetus which the establishment in 1897 of the pioneer, thoroughly equipped, rice mill in Georgetown gave to the industry. There is now under inception by the Government the erection of a factory for producing flour from rice, pulses, corn or maize, and similar grains. Its cost may be in the vicinity of $30,000. I think that sum will be well invested, and that British Guiana rice flour may in the near future become a regular article of export to the West Indian islands. At present there is a large amount of broken rice produced in the various rice mills, and it is hoped with suitable appliances so thoroughly to clean this by-product that it may be successfully converted into high-grade rice flour.

BRITISH COTTON GROWING ASSOCIATION.

In presenting the Thirteenth Annual Report of the work of the Association, the Council records with much regret the deaths of Mr. John Edward Newton, one of the Vice Presidents of the Association, and Mr. Edwin Stansfield. Both of these gentlemen were actively connected with the Association from its inauguration in 1902, and took a prominent part in the development of cotton growing.

Mr. H. Boothman, the General Secretary of the Amalgamated Association of Operative Cotton Spinners, has been elected a member of the Council, to fill the vacancy caused by the death of Mr. William Marsland.

Owing to reasons of health, Mr. J. Arthur Hutton has resigned his position as Chairman of the Association, and the Council has accepted the resignation with profound regret, and desires to place upon record its most grateful thanks for the whole-hearted and unremitting devotion which Mr. Hutton has given to the best interests of the Association since its inception. The Council recalls with gratitude the ability with which he has guided the Association's policy and work through many difficulties, until it has attained its present recognized position as an Empire institution, with every promise that its work and example will ultimately result in a large increase of British Empire-grown cotton. Mr. Hutton has been elected a Vice President of the Association.

The Council has decided not to appoint any permanent Chairman, but that the work shall be carried on by the present Executive Committee, with the co-operation and general superintendence of the Manager, Mr. Himbury. The Executive Committee have arranged to meet frequently at regular intervals, and practically to act as a board of directors.

As a result of representations made by the Council, a Committee has been appointed to consider the best method of continuing and developing the work inaugurated by the Association. A great deal of valuable evidence has already been placed at the disposal of the Committee, and a complete and exhaustive statement of the Association's case for the future development of the cotton-growing movement within the Empire was drawn up Mr. Hutton, and considered by the Committee.

Evidence was given by representatives of the Sudan Government, which showed that within a period of, say, twenty-five years about 440,000 bales of 500 lb. each could be produced annually in the Sudan by the aid of dam and irrigation works, but without any extra storage works.

Evidence was also given by Sir Murdoch MacDonald, the head of the Egyptian Irrigation Department, with regard to the possibilities in Egypt, where it is estimated that by drainage and irrigation schemes another 800,000 bales of 500 lb. each might be added to the Egyptian crop.

The Committee are still continuing their investigations.

Owing to the war no further efforts have been made to complete the raising of the capital, namely, £500,000, but additional subscriptions amounting to £114 have been received during the year.

The total capital subscribed is £477,034, of which £468,585 has been allotted in the form of shares. The balance of capital still to be raised amounts to £22,966, towards which £13,000 has been promised conditionally on the whole of the capital being subscribed, leaving a net balance of £9,966 still to be found.

Considerable difficulties and delays have again been experienced in shipping the 1916-17 cotton crop, but the Council are glad to report that, notwithstanding the very acute shortage of tonnage which has existed during the year, the whole of the 1916-17 cotton from West Africa and the Sudan has now been received in Liverpool. A considerable portion of the Uganda and Nyasaland crops still remains to be shipped, as well as the bulk of the Sea Island cotton grown in the West Indies. The shipment of the Uganda cotton crop has been a source of anxiety to the Council, but they feel confident that the Government will do everything possible to ensure the shipment of cotton from Uganda.

The total amount of cotton which has passed through the hands of the Association during recent years is shown in the following statement:—

Year.	Bales.	Value.
		£
1912	40,094	507,122
1913	47,466	661,227
1914	38,694	456,147
1915	48,087	627,763
1916	40,780	788,061
1917	39,191	1,415,644

The Council consider the results of the past year's working are eminently satisfactory, more especially in face of the transport and other difficulties which have prevailed.

The estimated amount of cotton grown in new fields in the British Empire in the last six years, stated in bales of 400 lb. each, is as follows:—

1912	71,490	bales.
1913	72,800	"
1914	82,350	"
1915	75,200	"
1916	78,800	"
1917	72,600	"

Reporting on work in the colonies, it is mentioned, in reference to the West Indies, that owing to difficulties in obtaining a sufficient supply of long stapled cotton for military requirements, His Majesty's Government found it necessary, in Imperial interests, to acquire all Sea Island cotton produced in the West Indies. The Secretary of State for the Colonies has therefore prohibited the exportation of this cotton, with a view to its purchase by the Colonial Government on behalf of the Admiralty. While Mr. Long regrets to interfere with the business arrangements of the agricultural community, he feels that he has no alternative to doing so, and he relies with confidence on the patriotic co-operation of the planters. All Sea Island cotton offered is bought, ginned, baled and delivered at the port of shipment, and the planters are accordingly relieved of all difficulties in the provision of tonnage.

The exports for the year ending September 30, 1917, only amounted to 892,867 lb., as compared with 1,005,288 lb. in 1916, and 1,823,956 lb. in 1915. There were also exported from St. Vincent 19,656 lb. of Marie Galante seed-cotton, of an estimated value of £204. The estimated production of St. Vincent was 160,168 lb., but a considerable quantity remained unshipped.

From the Virgin Islands were also shipped 1,170 lb. native, and 460 lb. of stains, the estimated values of which were £88 and £34, respectively.

Owing to lack of transport shipping facilities from the West Indies, a large quantity of the 1916-17 crop still remained on hand up to September 30, 1917.

In conclusion, the Council are of opinion that while the war, depletion of staff, discontinuation of the Government Grant, and other difficulties have prevented the undertaking of new developments in the year 1917, the Association may

on' the work of former years. The members have good reason to be satisfied with the present position, and with the bright prospects of the future. The Balance Sheet, with its surplus maintained at about last year's level, is evidence of the large business which has developed in the few years of the Association's existence. In comparison with Lancashire's requirements, it is true the British Cotton Growing production is small, but it is not negligible, and one must not lose sight of the fact that a very firm foundation has been laid for the benefit of Lancashire and the Empire. The Association's members may now see in the appointment of the Empire Cotton Growing Committee, evidence of having, by their cheerful sacrifices of the past, convinced the Government Authorities that the question of the development of cotton growing in the Empire is worthy of closer attention than it has hitherto received.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. During the month of August, 289 barrels of limes were gathered in the Lime Experiment Station, making a total crop since April of about 536 barrels. Plant distribution included the following: limes, 1,475; vanilla 100; Eucalyptus, 49; bamboos, 59; budded citrus, 23; grafted mangoes, 4; miscellaneous, 82; dracaena cuttings for windbreaks, 150. In addition, 155 packets of vegetable seeds, and 26 lb. of black-eye peas were sold. Regarding staple crops Mr. Jones states that the lime crop for the reason has reached the maximum, and is now on the decline. Ripe limes continue to sell at 4s. per barrel. The embargo on green limes and other lime products has been raised, and it is understood that shipments can be made freely. The free movement of concentrated juice and citrate of lime to New York, Mr. Jones says, will greatly help at this time, but it is too late in the season for much to be done in connexion with the green lime trade. The total rainfall for the month was 8·46 inches. High winds were experienced during the afternoon and evening of August 22. Fortunately but little damage was done.

ST. LUCIA. Plant distribution during the month of August included 2,500 lime plants, and 738 decorative and ornamental. In addition, 3 lb. of cotton seed, and 47 packets of vegetable seeds were sent out. Mr. A. J. Brooks, the Agricultural Superintendent, states, in regard to staple crops, that the cacao crop was setting, extension of the lime crop continued steady, while the sugar crop was making a good stand throughout the island. Special work had been undertaken in connexion with the eradication of Jove vine. The lime factory was working at fullest pressure, necessitating the regulating of the incoming produce. The Chula drier arrived safely, and has been erected at the Granary; it gave satisfaction during its first trial. The rainfall recorded at the Botanic Gardens, Castries, during the month, was 7·90 inches; at the Agricultural and Experiment Station, Choiseul, the record was 7·79 inches.

ANTIGUA. The following plants were distributed during the month of August: sisal, 3,229; henequen, 47; limes, 18; vegetable seeds, 213 packets; cotton seed, 446 lb. Some 20,000 sisal plants were imported and planted out in nursery beds in the Botanic Gardens. Mr. Jackson states that dry weather was seriously affecting the cane crop throughout the island. On the heavy lands, even with the best seasonable weather during the next few months, only very limited returns can be looked for. On such types of land root fungus is extremely prevalent. Some of the early cotton fields look promising, and cotton is being harvested from some of these. Others present a very indifferent appearance on account of the severe drought. Many cotton planters have not been able to get their crop established. Cotton stainers have been observed in moderately large numbers. Attacks of caterpillars were experienced, and some fields have been attacked by aphis. The rainfall for the month was 2·02 inches. Crops throughout the island, except on one or two estates, require rain badly.

Since the above notes were received, news has come to hand that welcome heavy rains have fallen, rendering the outlook much brighter.

NEVIS. Mr. W. I. Howell, the Agricultural Instructor, writes to say that during the month of August the plots in the Experiment Station have all been kept in good order, and the crops, on the whole, are doing a little better than in previous months.

Cotton in the demonstration plot is being reaped, but the first picking will be poor, as the plants are very small, and a number of the bolls were shed on account of the dry weather. Cotton worms made their appearance, but were kept in check by the use of Paris green. The following plants and seeds were distributed from the station during the month: cotton seed, 4 lb.; sweet potato cuttings, 1,600; and, in addition, 70 lb. of Paris green.

The cane crop throughout the island, Mr. Howell states, is very poor, and in some places presents a miserable appearance. In the windward part of the island the weather has been particularly dry, and the crops have suffered very much. The cotton crop in some places is doing fairly well, and picking has been begun, but the returns generally will be poor. In other from the crop is late, and the young plants are suffering much from want of rain. Cotton stainers are very plentiful, and in some of the early fields a very high percentage of the crop is stained cotton. Stainers have never been observed in such numbers so early in the season. Cotton worms were very active during the month, and many fields in the New Road district have been damaged through lack of proper attention, and the use of poison which was mixed far too weak to be effective. Provision crops in the Gingerland district are looking fairly well, but in other places they are much in need of rain. The rainfall for the month was 5 inches; for the year to date, 28·15 inches.

Agriculture in Barbados.—The first fifteen days of September were marked by low breezes, intense heat, and heavy downpours of rain at intervals in various parts of the island. These downpours were sometimes partial, but the whole island has registered a very satisfactory rainfall during the past fortnight, while in some districts the total already reached is much above the average. Roughly speaking it is already three times as much, and it has exceeded to date the total registered during any month this season.

The cane crop—the plant canes especially—is making excellent progress. One has but to visit a district at intervals of a fortnight to observe the strides made by some fields. All estates have now had their full supply of sulphate of ammonia, and planters have been busy putting in the second application to their ratoons. A good supply of Indian corn is being reaped. Field after field is being broken in, and the return in most cases has been satisfactory. (The Barbados *Agricultural Reporter*, September 21, 1918.)

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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*Seconded for Military Service.
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NOTES AND COMMENTS.

Contents of Present Issue.

In this number the editorial discusses the influence of records on devolopment, especially in connexion with agriculture.

Under the head Insect Notes, on page 314, will be found notes on insect pests in Porto Rico.

Plant Diseases present a description of moulds occurring on copra and coco-nut meat in the Philippine Islands, which are held to be responsible for the deterioration of these products both in storage and in transportation.

'The Crow and its relation to man', forms the subject of an interesting article on page 319.

How to Avoid Intermittent Bearing of Fruit Trees.

In a recent article in *Country Life*, it is maintained that the intermittent bearing of fruit trees can be avoided by a proper system of manuring. The writer, H. Vendelmans, says that, in spite of a very common belief, it is certain that the bearing capacity of fruit trees is not limited to every other year. Ninety-one orchardists out of every hundred in England assert that a good crop is followed by a thin crop, and vice versa: but the regularity with which excellent returns are obtained annually from espalier trees, and trees under glass, which receive different treatment from that meted out to orchard trees, ought to suggest some scepticism about the old tradition. In the case mentioned, it is possible to rely on good crops every year. Among the reasons which explain this more regular bearing, manure takes a first place. Without it, the abundant crop of one year makes so great a demand upon plant food that the reserves of the trees are exhausted, and are not strong enough to feed a new crop for the next year. Hence a poor return follows a good return. In the year following the bumper crop, the trees often carry no fruit at all, but they accumulate new reserves, and are then ready to feed a large crop the next year. When the exhaustion of the trees is prevented by appropriate manuring, bearing takes place much more regularly.

In manuring fruit trees, it is necessary to bear in mind that the blossom buds are formed the year before they come out, that is to say, during the period of bearing, or shortly afterwards. Consequently, they are forming at a time when the trees are being exhausted, or have been exhausted. Therefore, a liberal supply of easily assimilable manure must be placed at their disposal during this period. Liquid manure, wood-ashes, basic slag, and lime should be used, taking into account that a superabundant supply of nitrogen might lead to a production of wood instead of flower buds, and that phosphates assist in developing the flavour of the fruit.

This serves to emphasize the essential use of manures in orchard cultivation, if the best results are to be attained.

Buchu Cultivation in South Africa.

The Buchu plant, a hard perennial and evergreen shrub belonging to the rue family, is said to be indigenous to South Africa, but its culture there seems to have been neglected in recent years—as late as 1908, 240,742 lb. of leaves were exported. The high price now prevailing for buchu oil, however, is again stimulating interest in this plant to some extent in South Africa.

According to an account of the cultivation of the plant given in the South African *Agricultural Journal*, and quoted in the *Perfumery and Essential Oil Record* for August 1918, the leaves of the buchu, to which the value of the plant is due, are opposite or scattered, and are flat and dotted with oil glands; the

entirely revolute. When touched, or dry, the leaves emit a strong aromatic odour, which is due to a volatile oil contained in the glands This oil is greenish in colour when pressed out of the cells, and when left to dry upon the leaves forms a camphor-like substance.

There are three species of buchu plant used in medicine: the kloof buchu (*Barosma serratifolia*), the mountain buchu (*B. betulina*), and (*B. crenulata*). While containing the same essential oil and camphor, they differ in the shape, appearance, and colour of the leaves. The mountain buchu is probably the most valuable, as it contains the greatest number of oil glands in its small, light-green leaves; it is more compact and dwarfed than the kloof buchu, the leaves of which are dark green, resembling somewhat those of the orange tree (*Citrus Aurantium*). The *B. crenulata* species has larger leaves than the others, but this kind is not so widely distributed, and is consequently not so well known.

The buchu does not thrive in every soil. In its native state it is not found in earth having limestone as one of its component parts, nor in brackish or sandy soil and stiff clay. On the other hand, according to the species, a black or red sandy loam, impregnated with decayed vegetable matter, facilitates its culture. Good results, however, are said to be obtained when the plant is cultivated on sandy loam, properly drained and deeply dug, but not irrigated by brackish streams.

Alcohol Production from Wood Waste.

The demand for alcohol in industry increases enormously, and in the present circumstances especially, scientists are directing their energies to new sources of supply. The methods of producing ethyl alcohol may roughly be divided under two heads: (1) strictly synthetic, such as manufacture from calcium carbide via acetylene, and (2) fermentation processes, the materials for which are many.

Among the chief sources of fermentation of alcohol up to the present have been the various sugars found as such in plants, and the carbohydrates of grain and potatoes, but there are other sources to which much attention is being directed nowadays, and in a paper discussed at a recent meeting of Canadian chemists held at Ottawa, and published in full in *The Board of Trade Journal*, August 1, considerable importance is foreshadowed in regard to wood waste as a raw material in alcohol production. Two plants have within the last decade been installed in the United States, which are said to be economically producing high-grade spirit. The wood almost exclusively used is yellow pine, but it is stated that equally satisfactory yields are obtained from fir, spruce, and white pine.

By the process in use—heating under pressure with a dilute hydrolysing acid—as much as 25 to 28 per cent. of the anhydrous wood is rendered soluble, and of this amount as much as 80 per cent. can be delivered as fermentable sugar. It is not believed to be likely that a greater percentage will be obtained by the use of dilute acids. For the present, therefore, a conversion yielding 20 to 22 per cent. of fermentable sugars, or from 10 to 11 per cent. of ethyl alcohol corresponding to a maximum of, say, 35 gallons of 95 per cent. alcohol per dry ton, represents the immediate result. The actual average yields on a large scale have hardly exceeded half of this amount, so that there is a wide margin for improvement, and, to obtain this, investigation is now being carried out.

The quality of the product was reported to be one of the purest cologne spirits that had come under the observation of the analyst. It might be added that the plant, giving the above result, is operated at Fullerton, Louisiana.

Agriculture as a Business Proposition.

'British Agriculture as a Business Proposition' has been discussed recently at a meeting of the Agricultural Club, over which Sir Henry Rew, K.C.B., presided. The discussion was opened by Mr. J. H. Guy, the Assistant Financial Secretary to the Ministry of Munitions. After describing certain basic conditions of farming in the United Kingdom as they had struck him (an American), he asked his hearers to compare such conditions with those of a commercial undertaking. There they had a simple direct aim—the profit of the holder of ordinary shares. Every transaction is judged by that one standard. It was the creed of many commercial men that the more intelligently this object was pursued the more easily could it be reconciled with the rising standards of social obligations.

In farming, the fundamental objectives are much confused, and, for the moment at least, the British people seemed inclined to conduct agriculture as an insurance against a submarine siege of these islands, as a nursery of manhood, and a phase in a scheme for giving the returning soldier a strip of the land for which he has fought. However admirable these schemes might be, they are not intrinsically business propositions, though they can be reconciled with business, at a price.

If we grant the premise that farming is to be conducted for profit pure and simple, he would concur whole-heartedly in the application of the factory system to the farm, and would accept the conclusion as to farm labour that our choice lies between five labourers at £1 per week, and two labourers properly equipped and directed at £3 per week. He would, however, assume that any policy to command wide approval in the United Kingdom must effect a reconciliation between pure business and certain State requirements. This, however, was only the beginning of an answer to the questions, what is farming? and who is running it? which Mr. Guy thought were vital to the subject.

In trying to find an answer to these questions many phases of our farming were discussed, and among the conclusions arrived at were that the farming industry requires to turn over its capital more frequently, to control its purchasing and distributing machinery so that it can not pass on to every unwelcome interloper who can manage to intrude between the farm and the consumer. This can only be done by capital, combined with expert management.

INSECT NOTES.

INSECT NOTES FROM PORTO RICO.

The following notes are abstracted from papers by Mr. R. T. Cotton, Assistant Entomologist, Insular Experiment Station, Porto Rico. They are reproduced here, as being of general interest in the British West Indies, with comments on our local conditions.

THE EGG-PLANT LACE-BUG.

The egg-plant (*Solanum melongena*) is attacked by several pests, the worst of which is the lace-bug (*Corythaica monacha*, Stal.). This bug is widespread over the island and attacks the egg-plant wherever it is grown, causing heavy damage when not controlled by spraying. It feeds normally on the so-called wild egg-plant (*Solanum torvum*), and it is on this plant that it is able to survive during the interval between crops. *Solanum torvum* is one of the most abundant weeds on the island, growing luxuriantly in all parts and at all times, and it is undoubtedly owing to this fact that the lace-bug is so abundant. If it were dependent solely on the cultivated egg-plant for its food supply, it would soon die out, as the egg-plant is seldom grown at all times of the year, even in the most favourable localities.

The injury to the plant is occasioned by the feeding of the nymphs and adults, which congregate in hundreds on the undersides of the leaves, and suck the vital juices from the plant. Their presence on the leaves is first indicated by the appearance of small yellowish-brown patches, which growing in size soon involve the entire leaf, causing it to dry up and fall off. It is not an uncommon sight to see a whole patch of egg-plant entirely denuded of its leaves. The insect has a very short life-cycle, and multiplies so rapidly that, once introduced into a field, it soon spreads to every plant.

Control. This insect may be effectively controlled by a soap-and-water spray, 8 lb. of soap to 50 gallons of water being a good strength to use. The plants should be sprayed as soon after the appearance of the lace-bugs as possible, since it is much easier to control them then than later. (*Journal of the Department of Agriculture*, Porto Rico, Vol. I, No. 3, July 1917, p. 170.)

Although the egg-plant is not cultivated on a large scale in the Lesser Antilles, it is grown in vegetable gardens by a great many people who will probably be glad to know of such a simple and easily prepared control method as a soap-and-water spray.

The lace-bug in these islands is to be found on wild plants of the genus Solanum, and, as an aid to control, all the plants on which this insect occurs should be searched out and destroyed for some distance around gardens where the egg-plant is grown.

SCALE-FEEDING HABITS OF PORTO RICO MILLIPEDES

During investigations into the feeding habits of some of the common millipedes of Porto Rico, one was found to feed on the purple scale (*Lepidosaphes beckii*) on citrus trees.

This millipede is a large, dark, reddish-brown form about 80 mm. (3¼ inches) long, which has been identified as *Rhinocricus arboreus*, Saussure, which is recorded as occurring in several West Indian islands—St. Thomas, St. Croix, Antigua, etc.

These millipedes were observed to be feeding voraciously on purple scale on grape fruit. In the laboratory it was found that they thoroughly cleaned off the scales from infested grape fruit twigs in a short time. It was ascertained from actual count that one specimen consumed 2,000 scales in a period of three hours, and after a short rest resumed feeding.

Several small grape fruit trees which were badly infested with purple scale were selected, and in each about a dozen millipedes were placed. They at once commenced to feed on the scales, and at the end of two weeks these trees were clean and free from scales and they remained clean for some time.

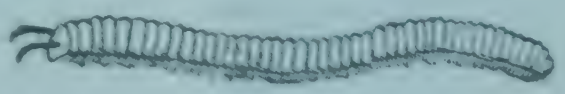


Fig. 3. Millipede.

These millipedes are not considered likely to be of any great importance in controlling scale insects, but this is an interesting note of a scale-feeding habit on the part of an animal supposed to be a vegetable feeder. (*Journal of the Department of Agriculture*, Porto Rico, Vol. I, No. 3, July 1917, p. 173.)

In all the islands of the Lesser Antilles millipedes occur which are much like this one, if, indeed, they are not the same species. They are often to be seen in cane fields, and after rains they may be seen crawling in the roads. When disturbed they curl up in a spiral. The accompanying illustration may serve to give an idea of the general appearance of a millipede.

SCALE INSECTS AND THEIR CONTROL.

Circular No. 9, entitled 'Scale Insects and their Control', issued by the Board of Commissioners of Agriculture, Porto Rico, gives an interesting popular account of scale insects, what they are, how they feed, and consequently, how they injure plants, and mentions a few of commercial value, such as those which produce Cochineal, lac, from which shellac is made, and a wax used in making candles in China.

The following paragraph gives an account of the agencies which work against the scale insects:—

'The scale insects have by no means a calm and undisturbed existence, for they are beset by many enemies. Many beetles of the Coccinellid family feed almost exclusively on them, and hymenopterous insects deposit their eggs inside the scale, eventually causing its death. In Porto Rico, the large brownish-black millipede, or 'gongoli' feeds voraciously on the purple scale of the citrus trees, and should be encouraged and introduced into the groves. Birds also feed to some extent on scales, and should be likewise protected and encouraged. Various beneficial fungi wage a deadly warfare against scale insects, and in Porto Rico the so-called red and black fungi are extremely effective in keeping down the scales in citrus groves. To provide favourable conditions for the growth of these fungi, it is necessary to grow wind-breaks all through the groves. These wind-breaks will do away with the strong winds which are unfavourable to the growth of fungi, and ordinarily the scales will be kept pretty well in check.'

It is stated that most scale insects may be kept in check by means of control sprays, and the following formula is given as being the cheapest and most effective spray yet devised for use in Porto Rico.

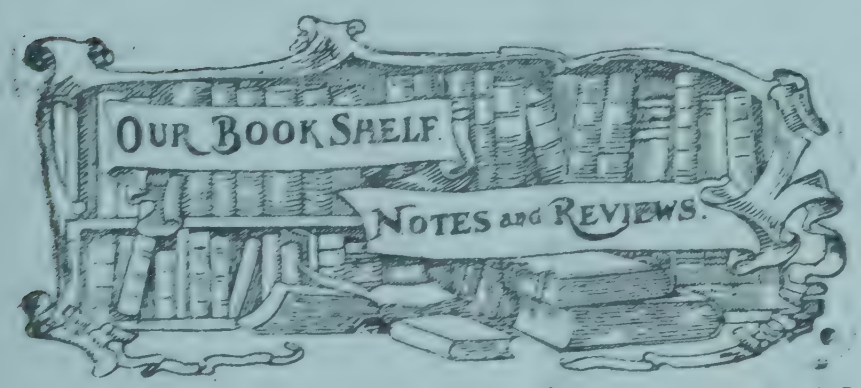
The Government formula for its preparation is as follows:—

'Soap (preferably whale oil	8 lb. or 1 gal.
Oil (Corvus or Red Junior)	2 gals.
Water	1 gal.

'Dissolve the soap in water by heating or allowing to stand overnight or for several days. Add the oil slowly in a thin stream stirring constantly. Stir in each addition of oil before more is added. This will make a stock solution of 4 gallons, which should be diluted 1 to 50, making 200 gallons of spray. The spray will contain 1 per cent. oil and 0·5 per cent. soap. Half a pound of sodium carbonate (commercial) per 100 gallons of spray, should be added to make the water soft; if the water is still hard, and a yellow sticky scum floats on the top of the spray, more sodium carbonate should be added. The stock solution will keep for several weeks after it is mixed, and the purplish-brown oil that comes to the top after it has stood a while may be easily stirred in with the rest when diluted for use. The Corvus oil may be obtained from the Texas Company, while the Red Junior Oil is supplied by the West India Oil Company. Carbolic acid will mix readily with the stock emulsion, and may be added, if desired, at the rate of 1 pint to the 4 gallons of stock solution. Directions for the use of this spray follow.

'The labourers should be instructed to spray the top of the tree inside, and not to confine their attention to the leaves and trunk. The spray is cheap, and an ample amount should be used to insure a thorough job. Immediate results should not be expected, but in two or three weeks the dead scales should begin to come off. They will come off easily if the hand is rubbed along a branch or leaf. Where the infestation by scale is heavy, the first spraying should be followed by another application a month or six weeks later. This will kill the scales missed the first time. If women are used to scrub the trunks, the best time to have them do it is between sprays, when they will get off the dead scales, moss, etc., which cover up the live scales beneath.

H.A.B.



THE SUGARS AND THEIR SIMPLE DERIVATIVES, by John E. Mackenzie, D.Sc., Ph.D., Lecturer on Chemistry, at the University of Edinburgh. *Gurney and Jackson, London* (1913). Price 7*s.* 6*d.* net.

In addition to their commercial importance, the sugars are of primary importance in the normal processes of plant and animal life, constituting as they do some of the main food substances both of plants and animals. A knowledge of their properties is therefore essential to a large and varied class of workers, including those concerned with plant and animal nutrition, such as physiologists, chemists, and those concerned with agricultural problems, and also those interested in the great industries of sugar production, fermentation, brewing, and distilling, to mention only some of the interests connected with sugar.

The great number and diversity of the sugars, and their chemical complexity make it impossible to deal adequately with them in general textbooks, consequently it becomes necessary to have recourse to special treatises, such as the one under consideration.

This book is the outcome of a course of lectures to students, delivered first at Birkbeck College, London, and subsequently at the University of Edinburgh. It is intended to serve as a source of information to students of chemistry more particularly concerned with sugar problems, and also as a companion to works on physiological chemistry, and to technological works on brewing, distilling, sugar manufacture, and sugar analysis.

The opening chapters, following a general introduction dealing with the general properties of sugars, and the synthetic methods of their preparation, give consideration to the sugars of principal physiological and commercial importance. Chapters II, III, and IV deal with sucrose, giving a simple account in outline of the methods of production and preparation of commercial sugar from the sugar-cane and beet-root.

Maltose and lactose form the subjects of the two following chapters. Three chapters are devoted to the consideration of glucose, the extended reference being necessitated by the great physiological importance of this substance: information is here brought together in a form convenient for study and reference.

In Chapter X consideration is given to glucosamine, *l*-glucose and its derivatives, and to inactive glucose. At this point, in Chapter XI, follows a useful study of the structure of the molecules of the various sugars as regards the arrangement and configuration of the constituent molecules. This chapter is calculated to be very useful, for it is convenient to have the main facts brought together for easy reference; critical students will find, however, that some progress has been made in connexion with these studies since the time when this chapter was written.

The dioses, trioses, and tetroses are dealt with in Chapter XII, the pentoses in Chapters XIII and XIV, the following two chapters being devoted to the hexoses; and appropriate consideration is given to the di- tri- and tetrasaccharides in Chapter XVII. A chapter is also devoted to the glucosides, and one to the consideration of the general principles of fermentation.

The work closes with a short chapter on metabolism, which is useful as showing the manner in which some of the sugars function in physiological processes. The work is arranged in a form convenient for study and for reference, and will be useful to students and workers in fields alluded to at the beginning of this review.

The format of this volume is excellent, the letterpress and clearness of the diagrams being commendable.

The June *Biochemical Journal* contains work on the antineuritic and antiscorbutic accessory substances by Messrs. A. Harden and S. S. Zilva. These authors find that when the precipitate obtained by shaking orange juice with dialysed iron is extracted with alcohol, the product will not cure guinea pigs of scurvy, nor will it protect healthy animals against attacks of the disease. But orange juice which has been treated with dialysed iron or with fuller's earth retains practically all its antiscorbutic activity. A mixture of equal parts of orange juice and autolysed yeast will both cure and protect from attacks of polyneuritis and scurvy. Orange juice can be filtered through a Berkefeld filter without losing an appreciable amount of its antiscorbutic activity. (*Nature*, August 29, 1918.)

GLEANINGS

We regret to have to record the death in Antigua, after but a few days illness, of Mr. Walter Conacher, the Manager of the Basseterre Sugar Factory, St. Kitts. Mr. Conacher had just returned from America, where he had successfully undergone a serious operation.

The bleeding of balata trees in British Guiana was actively carried on in 1916 in consequence of the high prices obtaining, and the record quantity of 1,450,702 lb. of balata was exported, the previous highest output being 1,350,526 lb. in 1913-14. (*Colonial Reports*—Annual, No. 937).

In the Preliminary Report of the Water-Power Committee of the Conjoint Board of Scientific Societies, which was issued in July 1918, it is noted that the falls of Kaieteur in British Guiana are said to form perhaps the finest untouched water-power in the Empire. It is also noted that the water-power possibilities of British Honduras are known to be large.

It is stated in *Colonial Reports*—Annual, No. 936, that the piassava palm is abundant along the river banks of one district of the Gambia for a distance of about 30 miles. The piassava industry has been in abeyance for several years, but in 1915 the cutting and preparation of the fibre was begun by a British firm. The work had not advanced sufficiently, however, by the end of 1916 to enable exports to be made.

The typical oil-palm, which is so widely distributed in the Cameroons, is called Dilombe or Dipobe, and its fruit contains a hard shell. A different variety (*Elaeis guineensis*, var. *microsperma*), which is known as Lisombe, differs in having a fruit with a thin shell, and is of only isolated occurrence: it never is gregarious, and in some districts it does not occur at all. Germany consumed more than half the world's commercial supply of the produce of oil-palms. (The *Kew Bulletin*, No. 6, 1918.)

The Agricultural Superintendent of St. Kitts, Mr. F. R. Shepherd, writing on September 13, reports that good rains had fallen in that Presidency. Since September 9 there had been a precipitation of 4 inches without any wash. This must benefit the cane crop, although Mr. Shepherd fears that some of the ratoons are past recovery. He further reports a good rainfall at Nevis: no news had been received from Anguilla.

Hitherto the oil-palm (*Elaeis guineensis*) has only been a wild crop, but it is of interest to note that recent attempts to cultivate it on the Gold Coast have met with remarkable success, the yield obtained in tilled soil at fair distances apart being more than three times as large as that from palms under native conditions. The establishment of similar plantations in the Federated Malay States and the Seychelles may therefore lead to far-reaching results, and under these more favourable conditions the oil-palm may so flourish that the native industry, unless properly cared for, may collapse and disappear. (*Nature*, August 15, 1918.)

The improvement of the natural indigo industry is a subject receiving much attention from scientific workers in India. A note in *Nature*, August 15, 1918, points out that Mr. C. H. Hutchinson has published a paper entitled 'The Importance of Bacterial Action in Indigo Manufacture', which shows that the yield of indigo from a given weight of indigo plant is found to depend upon the intervention of bacteria during the steeping process, and that while some bacteria operate beneficially, others are detrimental. In the absence of the former the yield is reduced, and the author considers that the presence of these beneficial forms could be secured by artificial inoculation.

Coffee cultivation continues to be an industry of increasing importance in the North Western District of British Guiana, according to the *Journal of the Board of Agriculture of British Guiana*, July 1918. The coffee farms are well laid out into rectangular fields, and are maintained under a proper system of drainage. The coffee, which is of the Liberian variety, grows luxuriantly, and bears prolifically. The soil of the district is so well suited to the cultivation of this crop that even in their early years of growth the young trees are capable of yielding 8 cwt. of coffee per acre, with trees planted at 300 to the acre. In 1917 the census returns show the area under cultivation to be 800 acres.

Ground nut oil-cake has been imported from India to the United Kingdom, Ceylon, and Germany. Ceylon has increased her imports from 17,000 tons in 1912-13, to 35,000 tons in 1915-16. These supplies come chiefly from Madras, and are largely used as a manure for tea, etc. In Europe, ground nut cake, as is well known, is regarded as a very valuable cattle food, and the manure produced by the animals fed on the cake is 'exceptionally rich in manurial value.' In India, interest is being directed towards the utilization of such oil-cake for sugar-cane and for wet lands. (The *Tropical Agriculturist*, June 1918.)

'How to Pay for the War by Developing the Latest Resources of the Empire' is the title of a recently published book by Mr. Harold Hamel Smith, the well-known editor of *Tropical Life*. The book contains an outline of the author's views in connexion with the development of the tropical and sub-tropical portions of the Empire, and of our trade relations with the nations of Latin America, and with Russia. The book is very suggestive, and is of great interest to those connected with agriculture or commerce in the regions referred to. Some of the views expressed may be legimately open to discussion, which will no doubt be welcomed by the author, as a means of drawing further attention to the object he has in mind.

THE CROW, AND ITS RELATION TO MAN.

In *Bulletin No. 621*, United States Department of Agriculture, is published a paper giving an account and the results of an investigation as to the economic status of the common Crow (*Corvus brachyrynchos*) in relation to its value or otherwise to man, undertaken by E. R. Kalmbach, Assistant Biologist, in response to the many urgent requests for a number of years for information touching the habits of this bird.

Some idea of the amount of labour involved, and the completeness of the investigations undertaken, may be gathered from the fact that no fewer than 2,118 stomachs of crows, both old and young, became available for examination. Effort was made also by means of 3,000 letters of enquiry, to secure reliable information as to the good or harm done by the crow, based on actual field observation. The data obtained have made it possible to present considerable trustworthy testimony, which, it is claimed, distincly reflects present conditions; the quantity and character of the combined evidence secured seems to justify the final conclusion reached as to the economic status of the crow in the United States.

Although not native to the West Indies, and confined in its distribution practically exclusively to America, yet the crow is of so world-wide reputation, that any available literature concerning its life-history and food habits, should be of interest to the general reader. For that reason, the information given below is abstracted from the source above-mentioned.

Practically omnivorous, the crow is capable of surviving in widely diversified environments. In its diet may be found everything from the choicest poultry and the tenderest shoots of sprouting grain to carrion and weed seeds. The fact that no less than 656 specifically different items were identified in the stomachs examined in course of this investigation, give some idea of the bird's resourcefulness, its potentialities for good or harm, and the complexity of the problem of determining its worth. Many complaints against the bird are well nigh traditional, while some of its beneficial habits have been matters of common knowledge for generations.

A brief summary of decisions reached, respecting each of the more economic problems that have arisen in this investigation, makes it possible to review, with some degree of thoroughness, the many-sided question of the value of the crow.

As regards its food habits, it is seen that the crow's destruction of insects presents the strongest argument in the bird's favour. Nearly one-fifth of the adult crow's yearly sustenance comes from such sources. That injurious insects greatly outnumber beneficial insects in the diet of the crow, is seen from a review of the four most important orders: beetles, grasshoppers, caterpillars, and true bugs. The crow's relation to beetles is all that the frugal agriculturist could desire. Foremost amongst these in its food are May beetles, and their destructive larvae, white grubs. In its consumption of grasshoppers, however, the crow renders man its most important service; in regions where these decidedly injurious insects are abundant, their nymphs form the principal insect-food of nestlings. In its consumption of caterpillars the nestling crow exceeds its parent in effectiveness in the ratio of 4 to 1. This food, found in over a third of the stomachs of young crows, is all in the bird's favour, especially since cut-worms constitute the major portion. Among the true bugs, only Pentatomidae, and the periodical cicada, are considered worthy of mention in the summary. The consumption of crustaceans is classed among the minor benefits conferred by the crow, while its feeding on the smaller snakes and lizards, and its destruction of the highly insectivorous amphibians, especially toads and frogs, are to be deplored, as such work is opposed to the best interests of man. The crow's destruction of wild birds and their eggs is a noxious trait of no small importance. It is somewhat mitigated, however, by the fact that most of the depredations on eggs occur early enough in the season to permit the raising of a second brood, at a time when there is little or no danger from crows.

As regards crops, corn is the principal food of the adult crow: it is eaten in every month of the year, and from October to January forms over half the bird's diet. Damage to wheat and oats is confined to sowing and sprouting time, and is by no means so serious as the pilfering of sprouting corn.

As a distributor of disease the crow, along with the turkey buzzard, has been a target for much unjust criticism. While the crow may be an agent in the transmission of live-stock diseases, it does not follow, it is argued, that even the extermination of this species would materially lessen the danger of infection. The crow's consumption of wild fruit in itself involves nothing of economic interest, as the embryos of the seeds eaten are seldom destroyed, and as this material is regurgitated after the digestible portion has been assimilated, it is apparent that the crow thereby becomes an agent in the dispersal of seeds.

In the following conclusion reached, the author appears to have fairly and accurately stated the position as regards the economic status of the crow in relation to its value to man:—

'When feeding on injurious insects, crustaceans, rodents, and carion, and when dispersing seeds of beneficial plants, the crow is working largely for the best interest of man; when destroying small reptiles, amphibians, wild birds, poultry, corn and some other crops, when molesting live stock and distributing their diseases, and when spreading seeds of noxious plants, the bird is one of the farmer's enemies; when destroying spiders and molluscs, however, its work appears in the main to have a neutral effect. The misdeeds of which the crow has been convicted greatly outnumber its virtues, but these are not necessarily equal in importance. Much of its damage to crops and poultry can be prevented, while the bird's services in the control of insect pests can ill be spared. At the same time no policy can be recommended which would allow the crow to become so numerous that its shortcomings would be greatly accentuated. As the capabilities of the crow for both good and harm are great, it is believed that an extermination of the species would have ultimate consequences no less serious than an overabundance.

'Inasmuch as this investigation aimed at reaching general conclusions respecting the status of the crow, in order that our attitude toward the bird might be based on sound economic principles, it may be said that the laws relating to it at present in force in most States, are altogether satisfactory. It is well that no protection be afforded the bird, and that permission be granted for shooting it when it is actually found doing damage. Bounties can not be recommended, nor can a campaign of wholesale destruction where complete extermination is the object sought. However, a reasonable reduction of numbers is justifiable in areas where there is an overabundance of the birds. The attitude of the individual farmer toward the crow should be one of toleration when no serious losses are suffered, rather than one of uncompromising antagonism, resulting in the unwarranted destruction of these birds, which at times are most valuable aids to men.'

PLANT DISEASES.

MOULDS OCCURRING ON COPRA AND COCO-NUT MEAT.

In course of investigations undertaken by the Bureau of Science, Philippine Islands, in the study of copra and other coco-nut products, involving experiments in connexion with the deterioration of copra and coco-nut oil both in storage and in transportation, due to the action of certain fungi, the following description of the moulds found to be responsible for such deterioration under the conditions obtaining in the Philippines, is abstracted from the results published in the *Philippine Journal of Science* for March 1917.

We have found four moulds constantly occurring upon mouldy copra and coco-nut meat. The spore masses of these four moulds differ greatly in colour, and hence the moulds are very readily distinguished even without the use of a microscope. In the order of the moisture necessary for their growth these moulds are *Rhizopus* sp. (white mould), a mould occurring only upon fresh meat, and there forming loose masses of white mycelium with many black sporangia; *Aspergillus niger*, van Teigh. (black mould), a mould occurring on copra with a relatively high moisture content, and producing black spore bodies which give the mould a black colour; *Aspergillus flavus*, Link. (brown or yellow mould), a mould occurring most commonly on mouldy copra—the spore masses are first greenish-yellow, later turning brown; *Penicillium glaucum*, Link. (green mould), a mould producing green spore masses and common on copra, especially that containing a low percentage of moisture.

RHIZOPUS SP. (WHITE MOULD) occurs only upon fresh coco-nut meat, and then only when the surrounding air is in a practically saturated condition. When moisture conditions are favourable, the growth of this mould is very luxuriant. It spreads by means of stolons, and in from thirty-six to forty-eight hours the mycelium frequently entirely covers a piece of coco-nut meat 10 centimetres in diameter with a tangled mass of aerial mycelium, which may attain a height of from 3 to 5 centimetres, and which is specked with small black sporangia. The aerial mycelium collapses upon the slightest drying. The spores germinate in about six hours in a hanging drop of coco-nut decoction. Although this mould grows rapidly and destroys a high percentage of the oil in the meat, it is probably the least important of the four moulds considered in this paper. It grows only upon fresh meat, and hence its growth is checked, and the plant killed almost as soon as drying commences. *Rhizopus* can rarely make any considerable growth, since the meat is usually treated or placed on the grate, and heat applied within the period necessary for the germination of the spore.

ASPERGILLUS NIGER, VAN TEIGH. (BLACK MOULD) plays a more important part than does *Rhizopus* sp., but a far less important one than does *Aspergillus flavus* (brown mould). It is the black mould often seen on badly moulded copra. Its moisture requirements are lower than those of white mould, but slightly higher than those of brown mould, and although it often grows with the latter, it appears only upon copra that contains at least 12 per cent. of water, and it makes its most luxuriant growth upon copra that contains 18 to 20 per cent. of water. Properly dried copra should not have such a high moisture content as is required for the growth of this mould. However, as copra is usually prepared in the Philippines, it often contains enough water for this mould to appear, and to make a considerable growth, and under such conditions it undoubtedly causes an appreciable loss in oil. Our experiments indicate that this loss may sometimes be as much as 40 per cent. of the total oil.

In hanging drops the spores germinate in about six hours, and the subsequent growth is rapid. In forty-eight hours the mycelium from a single spore may grow out and extend over an area from 3 to 4 centimetres in diameter. On a nutrient agar medium, such as coco-nut, prune, or string bean, the colonies are circular in outline, and the substratum is yellow. This colour is also often seen when the mould grows upon coco-nut or copra, and it appears to be characteristic of the species.

ASPERGILLUS FLAVUS, LINK. (BROWN MOULD) is the mould that plays the most important part in the destruction of the oil in copra. It is the brown mould that is usually seen on badly moulded copra. In many cases it is mixed with the black *Aspergillus*, discussed above, and often with the green *Penicillium* which is considered later. It occurs upon copra with a moisture content of from 7 to 8 per cent. — a water content lower than the average for Philippine copra—and because of its ability to grow on copra with so low a moisture content it destroys a very high percentage of the copra of the Islands. The oil destroyed may be almost 40 per cent. of the total oil contained in the copra. The oil expressed from copra upon which this mould has been growing also contains a high percentage of free fatty acid.

In hanging drops the spores germinate in from four to five hours. In nutrient agar media the mycelium becomes visible in from twelve to fifteen hours, and mature spores are produced in about forty-eight hours. The growth from a single spore is slow as compared with one of white mould or black mould, but the early production of spores leads to a rapid multiplication of colonies, and so the mould in a comparatively short time, will completely cover the surface of the meat of half a coco-nut.

PENICILLIUM GLAUCUM, LINK. (GREEN MOULD) is often seen upon copra. It grows well on copra containing a very low percentage of water. Analyses show that this mould destroys hardly any of the oil in the copra, and the production of free acid is low; therefore a good grade of oil can be made from copra upon which this mould has grown. Its growth appears to be almost entirely superficial. It can be readily removed by brushing, leaving a firm white copra. A growth of *Penicillium* alone may be said almost to serve as an indicator of good copra, because it grows at a moisture content between 5 and 7 per cent., causes practically no loss in the oil content, and produces very little free acid. However, green mould growing with one or both of the species of *Aspergillus* loses its significance as an indicator of good copra, as it will grow at any degree of moisture higher than 5 or 6 per cent., and the *Aspergillus* indicates a high moisture content. The reason green mould does not usually appear upon copra with a high degree of moisture is because of its slow rate of growth. The spores germinate in hanging drops in about six and a half hours, but the subsequent growth is slow, and colonies upon copra do not become visible to the naked eye until from about twenty-four to thirty-six hours after the spores are placed upon it. The colony grows very slowly, and mature colonies from a single spore are hardly ever more than 1 c.c. in diameter. The spores are mature in about eleven hours after the mycelium becomes visible. Due to the much more rapid growth of the other moulds, *Penicillium* is either crowded out or covered over by them, and under high moisture conditions it is only after the other moulds have stopped growing that *Penicillium* becomes visible.

THE STUDY OF COPRA AND COCO-NUT OIL.

The production of copra constitutes one of the leading industries of many tropical countries. In the Philippine Islands, practically the entire annual crop of about 431,387,000 nuts, with the exception of those used for local consumption, is turned into copra. Copra exports from the Philippine Islands for 1916 were 72,277,164 kilograms, and oil exports were 16,091,169 kilograms. The annual exports represent approximately one-third of the world's output; but Philippine copra is quoted lowest on the world's market.

In view of the importance of this industry to the Philippine Islands, the Bureau of Science has for several years undertaken work, and endeavoured to accumulate information with the object of suggesting improvements in the methods of drying copra, methods for the most effective recovery of the oil, and for preventing loss through deterioration of copra and coco-nut oil during storage and transportation, due to the action of moulds, and of other micro-organisms. The results of the latest efforts in this direction are presented in the Philippine *Journal of Science*, March 1917.

It was determined by experiment and observation, that moulds (of which four species are described,) grow most luxuriantly upon copra with a moisture content of 10 per cent. or greater, which is common in commercial copra, and which results in loss in weight; that there is a further loss in weight of copra on shipboard, which the copra dealers estimate at from 3 to 6 per cent., depending primarily upon the length of time of storage before shipment; that the losses incident to storage and shipment are not due entirely to the evaporation of water, but also to slow combustion which takes place with the formation of carbon dioxide and water, necessarily at the expense of the meat and the oil; that when properly dried to a moisture content of approximately 6 per cent., copra does not mould when stored where there is a circulation of air, and does not absorb sufficient water, unless in a saturated atmosphere for prolonged periods of time, to develop even a superficial growth of mould.

This poor quality of Philippine copra is, of course, dependent upon the methods employed. There are two general methods in use in the Philippines—sun-drying, and kiln-drying. The sun-drying method used throughout the southern islands is said to produce the better grade of copra; it consists simply in halving the nuts, without previously husking, and exposing the meat to the sun. Where sufficient care is exercised in the way of cleanliness and complete drying, this method produces an excellent grade of copra. In the other, which is known as the grill, or 'tapahan' process, the nuts are husked, halved, and placed on bamboo mats, under which shells and husks are burned. After the meat is partially dry, it is removed from the shells and subjected to further drying. Analyses showed that the finished product, as it leaves the drier, contains at least 20 per cent. moisture. But even with these two existing methods, it is suggested, a better grade of copra could be prepared if proper care were exercised in handling the product. By using sun-drying in conjunction with the tapahan, a more evenly dried product could be obtained. In the southern islands, where the drying could be carried on entirely by the sun's heat, the precautions said to be necessary would be to keep the copra free from dirt, and to secure more complete drying with facilities to protect it during short rainy periods.

The use of mechanical driers is suggested as one possible solution of the problem for improving the copra production of the islands, but these have not been introduced in a commercial way: mechanical drying machines have been discredited by the public through the erroneous belief that when coco-nut meat is dried in a current of hot air, a part of the oil is carried away from the copra. It was found as the result of experimentation, however, that when coco-nut oil was heated for four hours in a current of hot air at 100°C., there was no appreciable loss in weight.

The Bureau of Science has developed a simple method for the preparation of copra by treatment with sulphur dioxide gas, and allowing the meat to dry without the addition of artificial heat. The apparatus used is a wooden box provided with trays with split bamboo bottoms, and a 4-wheel car consisting of frame work and two pairs of small iron wheels mounted on a wooden track, twice the length of the box. The husked nuts are halved, and spread on the trays with the concave side down, the trays are loaded in the car and pushed into the box, and 8 kilograms of sulphur are next placed in a shallow pit under the car and ignited, and allowed to burn for from ten to twelve hours, liberating sufficient sulphur dioxide gas for the treatment. At the end of the sulphuring period the car is rolled into the open, and the meat removed from the shells with an ordinary copra knife, or allowed to remain for from four to five days, at the end of which time it has become sufficiently dry to allow of its ready removal. After free access of air for two weeks the sulphured material is cut up and sacked for the market. It is claimed that copra prepared by this method is clean and white, and free from mould, the oil expressed being practically colourless, and free from rancidity and acidity. The labour cost by this method should not exceed that of the tapahan or the sun-drying processes, and the initial outlay is small.

A further suggestion put forward as a result of these investigations, is that ripe nuts only should be used for the production of copra, because only fully matured nuts produce copra containing the maximum oil content. The nuts when opened should be kept free from dirt, and dried immediately, and without smoking, to a water content of 5 per cent.

The establishment of copra standards and organization of copra centrals by the Government have also been proposed, but for reasons given, it is shown that complete standardization would be difficult to establish.

So much for copra improvement.

Regarding suggestions of improved methods for the production of pure coco-nut oil, which constituted the second part of the investigation, a method for the production of pure coco-nut oil and a valuable press cake is outlined. This does not eliminate drying, but is a continuous process in which the meat is removed from the shells and ground as is done under the first method, which consists (a) in grating out the meat from the half nuts by means of a revolving burr, or (b) freeing the meat from the shell by treating the nuts with live steam for a period of from fifteen to thirty minutes before grinding. The meat is dried while still hot, and subjected to pressure for the removal of the oil. In this process a drier is used; the type suggested to be efficient could be constructed along the lines of a sugar drier. The meat would be machine-handled from the time that it is removed from the shells until the oil and press cake are reached. It is estimated that one expeller would be sufficient for a plant handling 45,000 nuts daily, giving an oil output of 6 tons. Over 80 per cent. of total oil can be removed in one operation. The oil obtained by this process is said to be water-white, is free from acidity and rancidity, and would command the best market prices.

MARKET REPORTS.

London.—The West India Committee Circular, August 22.

Arrowroot—No quotations.
Balata—Venezuelan Block, no quotations; Sheet, no quotations.
Beeswax—No quotations.
Cacao—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 4/6 to 5/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—9½*d.*
Rubber—Para, fine hard, 3/0½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., September 4.

Cacao—Venezuelan, $11·50; Trinidad. $12·75 to $13·50.
Coco-nut Oil—$1·46 per gallon.
Coffee—Venezuelan, 15c. per lb..
Copra—$7·25 per 100 lb.
Dhal—$11·50 to $12·00 per bag.
Onions—$10·00 per 100 lb.
Peas, Split—$8·00 per bag.
Potatoes—English, $4·00 per 100 lb.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros. & Co., July 12.

Cacao—Caracas, 13c.; Grenada, 13c.; Trinidad, 12¼c. to 13c.; Jamaica, 11½c. to 12c.
Coco-nuts—Jamaica selects, $42·00; Trinidad $40·00; culls, $20·00 to $21·00 per M.
Coffee—Jamaica, 9¼c. to 11c. per lb.
Ginger—15½c. to 16½c. per lb.
Goat Skins—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per lb.
Grape Fruit—Jamaica, importation prohibited.
Limes—Importation prohibited.
Mace—40c. to 45c. per lb.
Nutmegs—27c.
Oranges—Importation prohibited.
Pimento—6¾c. to 7c. per lb.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·055c. Molasses, 89°, 4·998c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., August 29.

Arrowroot—$12·00 per 100 lb.
Cacao—$12·00 to $12·50 per 100 lb.
Coco-nuts—$48·00 husked nuts.
Hay—$3·00.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $5·00.

Publications on sale of the Imperial Department of Agriculture.

The 'WEST INDIAN BULLETIN': A Quarterly Scientific Journal.

Volume XVII, No. 1. Containing Papers on Insects attacking Cotton Bolls, and a Paper on Fish Poisoning.

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The 'AGRICULTURAL NEWS': A Fortnightly Review.

The '**Agricultural News**' contains extracts from official correspondence, and from progress and other reports; and, in fact, any information indicating what is going on in each colony, and the progress made in agricultural matters throughout the West Indies.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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Compulsory Education

THE subject of education, the mistakes that have been made in educational systems in the past, and the improvement of such systems for the future, is one of the subjects that are taking up a great deal of attention in every part of the Empire. The new Education Bill just passed in the Imperial Parliament seems to hold out a hope that every child in the United Kingdom will in the future have an opportunity of being really educated. Similar schemes and provisions are being brought forward and enacted in all parts of the Empire. There seems, however, to be a certain amount of misunderstanding as to the meaning of education, and as to the manner in which it may be conveyed.

A fundamental error in this direction appears to be that of holding that education must be more or less compulsory. Now, strictly speaking, such a thing as compulsory education, in a real sense, can never exist. An article on this subject by Professor Jacks, in *Land and Water*, July 11, 1918, puts this in a very striking manner. He says truly that you can compel parents to send their children to school, you can compel the children, within limits, to learn lessons, but you can never compel anybody to be educated. All education is a joint operation of teacher and learner, and, unless the learner willingly contributes his share, nothing that the teacher can do for him, or compel him to do for himself, will make him an educated human being. He can only be educated by his own connivance. All real education therefore is by consent, and not by compulsion.

As the Professor points out, the word education carries a picture to the minds of most of us, of a school—the teacher sitting at his desk and ruling the situation with a rod of iron, and the children on the forms submitting to the system imposed upon them, and being punished if they refuse. In fact the notion is deeply rooted that education consists in imposing a system upon those who in the last resort must be coerced into receiving it.

That is how the matter comes to be conceived when we treat education, as we almost invariably do, as a schoolmaster's problem. Fundamentally it is nothing

of the kind. It is a social problem. It means the provision of the chance of acquiring the knowledge best suited to the requirements of each individual, and of all collectively. Education in fact does not consist alone in imparting a knowledge of subjects which it may be desirable in the abstract that people should be taught, but still more definitely the imparting of what they are capable of assimilating, and of what they are willing to learn. Looked at in this way, it is evident that compulsion, in the strict sense of the word, is inapplicable to education.

It would appear therefore that if the education of the future is to be as successful, as we all hope it will be, we must abandon the old attempt at compulsion. That is to say the action of a learned minority, who think themselves possessed of the right or the power to impose their type of intellectual attainment on the community in general, must be abandoned.

Those whom we style the uneducated masses are really not indifferent to education, but they distrust to a large extent the particular sort of education that has been offered them in the past, as being of no particular value to them. Moreover, they resent the notion that the community is divided into two classes—an educated and an uneducated—and that the former are the masters of a school in which the latter are the pupils, bound to learn what they are taught, and to believe what they are ordered. Their notion of education, and it seems a sound one, is that it must take the form of teaching them to make the best of the life they have to live. The education that has been offered them has little or nothing to do with that life. It is at best an ornament. There seems to be a fine idea at the back of such notions, namely, that anyone's life hard though it may be, may be transformed into a fine and noble life, if only the individual were educated for that object. This applies to agricultural communities most especially.

Professor Jacks, in the course of his article, instances the Germans. The Germans are the greatest exponents of compulsory education the world has ever seen. In their own eyes they are the educated class of the universe, and their policy accordingly is to impose their culture on the rest of mankind. Germany is to be not merely the master, but the schoolmaster of all nations. She alone knows what is good for them. She alone is to wear the cap and gown, and to wield the rod. The others are to be forced to accept her culture, and to accept it with delight and gratitude. This is compulsory education carried to its logical conclusion. The answer of the world to these would-be German masters in the school of mankind is that we all want education, but we are not taking the kind you want to cram down our throats.

By giving up the notions and abandoning the policy which makes education an attempt by one class to force its culture on another which does not want that particular kind of culture, we might surely find a better way. It seems possible, especially under the conditions of our time, that a type of culture might be found, of which it might be said that it is education not by compulsion, but by consent. In such a system teachers and taught might be at one in what they value, and in what they desire. Both might become co-operating partners in the pursuit of a common aim.

In this connexion, Professor Jacks remarks that a few simple principles need to be grasped and applied. First, that every man is essentially what his labour makes him, and that unless he is educated by his labour he is not educated at all. A proposition which would seem to hold true about every man, no matter what his station, from the highest to the lowest. The educated man is the man who understands everything about his own job, and enough about other people's jobs to enable him to co-operate with them intelligently in the social machine. To this principle may be added the further indisputable truths: that the happy man is the man who enjoys his job, and that the only good man is the man who does his job to the best of his ability.

From these principles we get a view of the ultimate object of real education. The aim must be not merely to educate labour, but to see that all labour becomes an education. In fact, education is not merely a schoolmaster's problem, though it includes that, but a social problem, only to be solved in connexion with a wide and broad conception of the needs, aims, and value of every human life.

Now, if we come to apply these principles to West Indian conditions, we see the mistakes of the past. The interests of these islands are almost entirely agricultural. In the system of education followed hitherto the plan has rather been scholastic or commercial, both in primary and secondary or higher grade schools. The results have been, only too generally, that the pupils have not been really educated, that is in the sense of placing them in accord with the conditions of their lives. It must be borne in mind that it is by no means advocated that too early vocational education should be

resorted to, That would only lead back again to compulsory instruction. At that stage of mental development children would not be capable of assimilating a mass of technical details, nor would they be sufficiently grounded in essential knowledge of facts to do so. But if the system of education should have, from the outset, the aim of interesting children, whose future life and work will be mainly rural, in rural matters, by getting them to see that agricultural work and life have a dignity quite as great as any other kind of employment, and that there is a divine joy in causing the earth to bring forth fruit, a long step will have been taken in the direction of a well educated population. Hitherto the education in country schools has been divorced to too large an extent from the realities and pleasures and duties of the ordinary life of country children.

It is well to cease thinking of education in terms of school, and to learn to think of it in terms of labour, remembering that labour is the common raw material of all human life, and giving to the word a meaning sufficiently broad to cover every man who has a definite status and occupation in the social fabric. The aim of education is that every man shall be trained to enjoy his day's work, and to produce a good article, whatever the article may be, from a picture to a brick, at the end of the day.

VENEZUELAN PRODUCTION OF BALATA.

Balata, the gum similar to gutta-percha, and largely used in the manufacture of belting, is obtained from the sap of *Mimusops globosa*, a tree reaching 100 feet or more in height, which is widely distributed over Eastern Venezuela and the Guianas. The latex is stated to be secreted between the bark and the wood of the tree; it contains nearly equal proportions of resin and gutta, the latter being identical with true gutta-percha. Notes on the commercial exploitation of this tree in Venezuela are given in the June number of the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases* (1918), from which the following interesting information is abstracted.

The word 'balata' is of Carib origin, and is used by the natives of British, Dutch, and French Guiana, as well as by those of Venezuela, but it is applied solely to the gum, the tree being known as the 'purguo'. On the coast between Puerto Cabello and Cape Codera the tree is called the 'nisperillo'.

The commercial exploitation of this tree in Venezuela began near Maturin, where by 1894 it had been already exterminated. Sap collecting was then begun near San Felix in the State of Bolivar, and, as the tree became scarcer, the area of operations was extended eastward to the boundary of British Guiana, and southward along the Orinoco and its tributaries, to all accessible regions. In Venezuela the custom is to cut down the trees in order to obtain the sap, and the industry has thus been progressively destroying itself. A governmental commission estimates that in the last ten years alone the 10,000 collectors have destroyed 36,000,000 'purguo' trees, and that the direct loss to the nation from this cause amounts to more than half a billion dollars. In spite of the fact tbat in British Guiana and Dutch Guiana felling is prohibited, and that regular production of latex is obtained by tappings that do not kill the trees, the merchants of Ciudad Bolivar have opposed any governmental prohibition of the cutting down of trees, arguing that in whatever manner the tree is cut it will die, and that there is no better method of obtaining the latex than felling.

The 'purguo' is of slow growth, the period required for a tree to reach the productive stage being more than ten years, and full development not being attained for thirty years or more. The fruits, being agreeable in taste, are nearly all eaten by wild animals, so that natural reproduction is slow. The trees usually grow at the foot of hills where the soil is fertile and moist, but not water-logged, always scattered among other species, and never densely. Land on which there are sixteen 'purguos' to the acre is considered rich.

The balata harvest begins in May and ends in August, but in years of continuous rains work may be carried on at all times, except when the tree is in flower, the sap being then so poor as not to be worth gathering. The collector leaves his camp at 5 a.m., fells the first tree he finds, and makes four cuts on each side of the fallen trunk, to each of which he attaches a tin receptacle to catch the flow of latex. Having worked two trees, he returns to his camp about noon, carrying the product of his toil in a bag, waterproofed with the same sap. The contents of the bag are emptied into a large receptacle. On Saturday all the collection of the entire week is coagulated by cooking, and afterwards the gum is pressed in wooden moulds into slabs weighing from 50 to 100 lb.

Under present methods, the average production per tree is 3 gallons of latex, yielding 18 lb. of balata worth from 15c. to 40c. a lb. By tapping properly it is estimated that each tree would produce latex worth $2 each year for thirty years or more.

For a number of years balata, ranking immediately after coffee and cacao, was third in importance among Venezuelan exports.

The war has caused great changes in the course of the trade in Venezuelan balata. During 1913 Germany led among the buyers of the gum on the Ciudad Bolivar market, France ranked second, the United States third, and Great Britain fourth. In 1914 the United States rose to first place, followed by France, Germany, and Great Britain in the order named. In 1915 Great Britain occupied first place, the United States was second, and France was a poor third, Germany disappearing from the list. In January-June 1916, Great Britain and the United States again ranked first and second, respectively, and France and Germany were both missing from the list.

In 1916 the price of balata in Ciudad Bolivar reached the then high mark of 35c. a lb., the average price is between 14 and 21c. The best price in 1915 was 23·7c., but the latest official tariff of exportable products, issued by the Ciudad Bolivar Custom House, fixed the official valuation of balata at 5 bolivares per kilo, or 43·8c. per lb.

SUGAR INDUSTRY.

CONTROL OF SUGAR PRICES BY THE INTERNATIONAL SUGAR COMMITTEE.

The following announcement to the trade was issued on September 9, 1918, by the International Sugar Committee from their New York Office:—

By direction of the United States Food Administration, the International Sugar Committee announce, effective at once, a temporary basic price of 7·28c. per ℔. delivered duty paid, for 96° centrifugal sugar, refining points, for the sole purpose of determining the refiner's selling margin under their voluntary agreement with the Food Administration. This means that the refiner's selling price, effective at once, will be 9c. per ℔. less 2 per cent. usual terms.

The above announcement in no way changes the basic price of 6·055c. fixed June 21, 1918, which remains the basis for the purpose of 96° centrifugal sugar by the International Sugar Committee as heretofore, and until further notice.

THE FOOD VALUE OF THE SUGAR-CANE.

An article on sugar and its value as a food appeared in the *Agricultural News*, August 24, 1918, and with reference to the same subject the following, by a correspondent of the Barbados *Agricultural Reporter*, under the nom de plume, 'Pentosans,' is reproduced from the issue of that paper for September 19, 1918, as showing clearly what a valuable source of food these islands possess in the sugar-cane in its untreated condition.

'Apart from its value in the production of sugar, the sugar-cane is extremely valuable as a food. The following table will convey at a glance the true food value of the cane:—

Constituents of sugar-cane.	Average per cent.	Contents of 1 ℔. average cane in grammes.	Food value of 1 ℔. average cane in calories.	Description of calories.
Water — —	72·00	326·60		
Sugar — —	13·10	59·42	244	carbohydrate
Reducing Sugars	1·00	4 54	19	do.
Fibre — —	12·00	54·43		
Ash — —	0·55	2·49		
Organic non-Sugar	0·75	3·40		
Nitrogenous bodies	0·60	2·72	15	protein
	100 00	453·60	278	

'The average adult doing an average day's work requires 3,400 calories. Therefore, 12·23 ℔. of cane contains the necessary calories to support a working adult for one day. In eating (sucking) the cane there is a very great waste, as the node is not eaten as a rule, and much of the inter-node is lost with the rind. The average loss in eating cane is about 50 per cent.; therefore the actual amount of cane required to give the necessary calories would be 24·46 ℔. It will be seen by the table that the protein content of the cane is very low, and in dealing with food values protein plays a most important part, as it is the only energy-producing item that replaces the wasted tissue of the body, and therefore an adequate supply is essential to keep the body in good repair. The irreducible minimum of protein required for an average adult is 60 grammes per day, and to get this amount of protein from the average cane by eating, an adult would have to eat 44·12 ℔. of cane. That the average adult can live on this amount of cane for a certain period there is not the slightest doubt in my mind; but eventually, serious disorders would attack the digestive system, from lack of solids to give the involuntary stomach muscles the necessary exercise.

'The following ration table contains the necessary 60 grammes of protein, and is the most economic way in which the sugar-cane can be used as a food without ill effects:—

IRREDUCIBLE MINIMUM DAILY RATION FOR ADULT.

	Weight in ℔	Protein Calories.	Fat Calories.	Carbohydrate Calories.	Total Calories.
Flour	0·75	208	32	1,053	1,293
Sugar-cane	17·06	128	—	2,234	2,362
		336	32	3,287	3,655

'The great loss of 50 per cent. of the food value of the cane by eating can be greatly reduced by the use of a handmill of simple construction, with two rollers. With such a mill, 70 per cent. of the food value of the cane could be recovered. This would be a great saving, as it would reduce the daily ration of 17·06 ℔. of cane to 12·13 ℔. A ton of average cane treated by a hand mill is worth 206·47 ℔. of best flour, or $17·55. It is remarkable that the small growers of canes have never attempted growing canes as a food. There is no season for canes, they ripen in about fourteen months. If a small grower were to plant in June, he would have his crop ready for sale in August of the following year, when there would be a great scarcity of cane, and he would get a fancy price—probably about $20·00 per ton—selling in small quantity. There should not be any set planting season for the small growers of cane; a portion of their land ought to be planted in canes every two months. This would give a continual supply of ripe, sound cane. If this were done, the small grower would be much better off in pocket than he is at the present time, and the masses would be better off by always having a good and wholesome food supply.'

FILTRATION OF CANE JUICES.

The above subject is discussed by E. W. Deming, in the *Louisiana Planter* for August 3, 1918, with a view to showing the losses that are incurred under the present system of filtration adopted in sugar houses. The writer points out that the use of multiple mills operated under high pressure, and the heavy maceration at high temperature yields a juice heavily laden with suspended impurities, such as gums, wax, etc. which when acted upon by lime and heat produces compounds and colours which can only be removed by the use of animal charcoal as employed by the refiner. He contends that the present system of removing these impurities is radically wrong. The suspended impurities, he suggests, 'should be removed from the juices in the cold state, before the application of heat and lime, by filtration through cloth, after which the juices carry only the impurities in solution, a very small proportion of the whole. Cold juices filtered would require a minimum of lime; there would be no colour formed by lime acting on cane fibre. The juice could pass through a heater, and be discharged directly into the body of the first evaporator, and no clarifiers or settlers used. There will be no surface scums, and no settled ones to foul the evaporator walls or tubes. By filtering this syrup, then applying sulphur, there can be obtained a white sugar. One or two boilings will exhaust the sugar, and the molasses will be of high grade, fit for human consumption.

'The heavy crushing of modern milling carries into the juices a finely subdivided fibre, nearly pure cellulose, known as bagacillo, which is always maintained in suspension in the cleared juices. This bagacillo absorbs and reflects light, so its presence is not suspected – even in the brightest juices in a sample test tube. It cannot be removed by any form of settling, but is partially removed by passing the settled juices quickly over a fine perforated screen placed nearly horizontal. It can only be removed by the restraining action of some filtering medium, using cloth as a backing.

'During the process of granulation the bagacillo becomes discoloured by the molasses, and its presence is noticeable in a dissolved sugar solution within a test tube. It is retained in the sugar, not washed out with the molasses. It furnishes the necessary binder for the formation of scale upon all the heating tubes. It is uniform in its distribution throughout the sack of sugar; it bulks up the sugar, causing air spaces; it absorbs moisture from the air, which it communicates to the surface of the grains of sugar. This moisture induces a ferment, which continues increasingly in action so long as conditions are favourable. Its injurious effect is greater than that of all other suspended matters found in the cleaned juices, and it should be removed. Any form of filter removing this bagacillo will also remove all other suspended matter.

'There is at present no process of clarification that gives uniformly satisfactory results. The removal of all precipitate possible by settling will be unsatisfactory if the bagacillo still remains.'

The writer claims to have given twenty-five years of service to juice-handling devices, on which he has many machine and process patents. He is quite convinced of the hopelessness of looking for further improvements in existing systems or processes, except one that is based upon a filtration of the entire juice output – otherwise the bagacillo must be reckoned with. He points out that the juice from, say 1 ton of cane, contains at the most 30 lb. of filter cake of 50 per cent. moisture—a very small amount. To filter these juices coming direct from the heater with this 1·5 per cent. of mud, each gallon carrying its own proportion of mud, would require a considerable time (even if the filtered juices were perfect) before there was secured a filtering medium on the cloth, so that pressure could be used and quantity work begun. Clarified juices present the same objections to filtering them separately, and they contain less solids than accompany the juices as they leave the heater. To filter volumes, there must be large surfaces, a pressure at all times, and no cloth used as a restraining medium (no matter how heavy) can be depended upon as a filtering medium under the action of pressure.' 'Not until a filtering is secured can we obtain in volume good filtered juices working under pressure.'

Sugar-Cane in Costa Rica.—The United States Consul, resident at San José, Costa Rica, in his report in May last, according to the *Louisiana Planter*, August 10, 1918, gave some interesting data concerning sugar in that country. For many years Costa Rica has been noted for the excellence of its coffee, and Costa Rica coffee generally commands considerably higher prices than coffee coming from Brazil. Attention is now being given to the sugar industry, and at the prevailing prices it is probable that this industry will receive considerable expansion. It is reported that the production for 1918 was 30,000,000 lb., or 15,000 short tons, as against 62,000,000 lb., or 31,000 short tons for the year before. The area under cultivation in 1917 was 21,830 acres. Planting is reported to be done at the beginning of the wet season, which varies somewhat, and the growing time for the first crop extends for two wet seasons and one intervening dry season, thus approximating eighteen months, after which the cutting is done annually. The small crop of 1918, while based on common report on various local causes, is most likely the result of the general drought throughout the world, and insufficient rainfall to produce a normal crop. The local consumption of sugars in Costa Rica is reported as about 6,000,000 lb, and the national liquor factory took 2¾ million lb. of molasses. It is estimated that 2½ million lb. of sugar or molasses was fed to animals.

FEEDING VELVET BEANS TO PIGS.

The *Experiment Station Record* for June 1918, records the results of experiments comparing the use of velvet beans with corn and dried blood for fattening hogs. The farmers of Alabama are using the velvet beans in two ways with hogs. The more common method is to sow the beans along with corn, and to gather the corn after frost has killed the velvet bean vines growing over it, and then turn the pigs in the field. The other method is to gather the ripe beans and feed as a concentrate.

An experiment was made with three lots of pigs of five each with corn and dried blood, 10:1, as concentrates. Lot 1 was fed a full ration alone, lot 2 a half ration (2 lb. to each 100 lb. live weight) with the pigs on velvet bean pasture, and lot 3 a one-fourth ration (1 lb. to 100 lb. live weight) on velvet bean pasture.

Valuing the corn at $1 per bushel, the dried blood at $60 per ton, and the velvet bean pasture at $2·83 per acre, it cost $6·59 to produce 100 lb. increase in lot 1, $4·91 in lot 2, and $4·02 in lot 3.

In another experiment, lot 1 was fed corn meal, and lot 2 corn meal and velvet bean meal without the pods. 1:1. It took 483·57 lb. of the corn meal to produce 100 lb. gain, and 537·64 lb. of the mixture. Valuing the corn at $1 per bushel and the velvet beans at $34 per ton, it cost 8·64c. per lb. of gain with the corn meal, and 9·37c. with the mixture.

The melting point of the lard from the corn-fed lot was 46·04°C., and from the corn meal velvet-bean meal lot 44·35°. The carcasses of the latter were slightly darkened. All carcasses were firm.

These experiments seem clearly to demonstrate the advantage to be derived from feeding velvet beans to pigs as a ration in combination with corn and other feeding stuffs.

Pig raising in the West Indies on a commercial scale has from time to time been advocated in various numbers of the *Agricultural News*, and the possibilities of an industry established on proper lines foreshadowed. The great scarcity and the high prices demanded and realized for marketable pigs at the present time should prove an incentive to the establishment of pig-raising farms in those colonies possessing lands well adapted for the purpose. The results of the experiments mentioned above should supply a further encouragement, showing as they do the advantage of using velvet beans in the ration for pigs, and indicating an additional and easily procurable feeding stuff; for the velvet bean grows readily in these West Indian colonies, and could without difficulty and at small expense be established in pasture for purposes of pig-raising.

It may be well to remember that the foregoing results apply also to Bengal Beans, and other species of Stizolobiums.

COCO-NUT CULTIVATION IN BRITISH GUIANA.

In the *Agricultural News* of September 7, 1918, a review of Professor Harrison's able address as President of the Royal Agricultural and Commercial Society of British Guiana appeared. In that review the position of the colony with regard to coco-nut cultivation was briefly noticed. In view, however, of the increasing interest in this question in these islands, it seems advisable to reproduce in the following paragraphs the major part of the Professor's remarks on the subject:—

In the late seventies and early eighties some impetus had been received towards the cultivation of coco-nuts in the Mahaicony-Abary district, where there are great areas of relatively light loamy to sandy lands, especially well-suited to the growth of coco-nut palms. The late Honourable B. Howell Jones's paper in Vol. II of *Timehri* for 1883, entitled 'A Visit to the Oil and Fibre Works at Plantation Fortitude' supplies a striking picture of the coco-nut industry at that time. The industry, as appears to be the rule with industries here in their earlier stages of inception, later fell into a condition of temporary stagnation, so that in 1897 there were, including scattered trees, not more than 3,500 acres under coco-nuts in the whole colony. The following is practically the only reference of any importance to the cultivation of coco-nuts in this colony which appears in the report of the West Indian Royal Commission :—

'The cultivation of coco nuts has existed in British Guiana from an early period, but it has apparently never attained large dimensions. This is probably due to the unsuitable character of the stiff clay soils on the coast, and to the prevalence of disease. In 1847 the number of coco-nuts exported amounted to 466,530. At present, large quantities of nuts are used locally by the East Indian immigrants. The recent exports are only slightly in excess of those of 1847. Mr. William Smith's evidence before the Special Commission in 1895 indicated that at Mahaicony Creek and other localities the conditions were favourable for coco-nut cultivation, but the nuts were small, and consequently they fetched low prices. The present condition of the industry deserves to be carefully investigated Only specially selected lands should, be planted, and suitable manures applied to ensure large nuts':

This statement could not be regarded as encouraging, and hence little attention was given towards the extension of the coco-nut cultivation, until the arrival of Sir Alexander Swettenham from the Straits Settlements in January 1902 brought a different aspect to bear on coco-nut growing. His experience there had taught him that successful cultivation of the coco-nut is not confined to light or sandy soils near the seashore. He was aware that heavy crops of coco-nuts, although the nuts may be of relatively small size, are obtained from strains of coco-nut palms which have become accustomed to growth on clay-loams or on heavy clay soils. He saw here coco-nut palms bearing crops of exceptionally large numbers of coco-nuts, and he reasoned that if this is the case on trees, isolated or in widely scattered small clumps, there should be no reason why similar heavily bearing palms should not be grown over large areas.

At first Sir Alexander feared that the relatively small size of the nuts produced here would stand in the way of an export industry, and he moved the Board of Agriculture to import selected seed-nuts from Singapore: but before these nuts arrived he had seen nuts from Wakenaam and from near Lichfield in the Abary district which more than favourably compared with those received later from Singapore. The Singapore nuts were sprouted, and some of the palms obtained from them were planted at the Experimental Fields; the majority of them, however, being set out at Onderneeming. Some thousands of nuts yielded by the palms raised from the Singapore seeds have been distributed for planting purposes. Sir Alexander Swettenham was, as he was in every way, energetically aided by the late Sir Alexander Ashmore, who was largely responsible for the preparation of the earliest leaflet published by the Board dealing with coco-nut planting. Oftimes Mr. Ashmore, as he then was, told me: 'I have never anywhere seen coco-nut palms bearing such great numbers of nuts as many of them in Georgetown and its vicinity do.'

In January 1903 the total area planted with coco-nuts was under 3,800 acres, but an impetus to coco-nut planting was at once given by Sir Alexander Swettenham's views so that the area had increased to 5,140 acres at the end of 1904 just after Sir Alexander Swettenham had relinquished the Government of the colony. Since then coco nut planting has regularly and steadily increased, so that on December 31, 1917, not less than 23,870 acres had been so planted in British Guiana.

Recent enquiries have proved that the ripe nuts from coco-nut palms, growing under the climatic conditions prevalent on the front lands of the colony, not only contain as high a proportion of oil as do nuts, the products of any other country, but are capable of yielding copra of exceptionally high oil-content, hot-air dried copra from them having been found to contain from 72 to as high as 79 per cent. of oil. Medium-sized nuts yielded the highest proportion of oil in their copra, both as sun dried (76 per cent.), and as hot-air dried (79 per cent.).

Since Sir Alexander Swettenham left us we have found experimentally that the most reliable kinds of seed-nuts for planting purposes are medium-sized ones, yielded by palms which are flourishing—not merely existing—on lands of like nature to that on which the nuts are to be planted, and under similar climatic conditions. It is not wise to endeavour to improve our strains of coco-nut palms by planting seed-nuts obtained from palms growing on the far lighter soils of Trinidad or Tobago or of any other country; those obtained from Wakenaam, from near Aurora, and perhaps from elsewhere in Essequibo, and specially selected seed-nuts from the Mahaicony-Abary District will give better and more vigorously growing palms, and what is more important, palms more resistant to adverse climatic influences than such imported ones will be. The sole exception to this that I am aware of are a few, a very few, of the strains imported at the instance of Sir Alexander Swettenham from the Straits Settlements.

Dr. Cramer, late of Surinam, and now in Java, is strongly of opinion that a strain of coco-nut palms specially fitted for growth on heavy clay soils, and resistant to our local climatic conditions, has been naturally evolved in British Guiana in the course of many years' growth under these conditions.

On the other hand, from what I have seen during recent years of local coco-nut palms, I believe that the average annual yields from trees vary from probably less than five to as many as 150 nuts per tree—some trees here being of remarkably heavy bearing power—but, as a rule, farmers will just as soon set seed-nuts from a palm of five-nut type as from one of 150-nut strain.

Planting coco-nut palms from nuts without reference to the bearing power of their parent palm, either in number

or size of the nuts, or to its suitability to the kind of soil the seedling is to grow on, appears to me to be a singularly unwise proceeding. It is hoped to get a palm yielding crops of nuts from its seventh to its fiftieth or sixtieth year—a permanent investment—and yet the planting is done in a manner which cannot be regarded as less commercially unsound than investing capital in a risky business yielding less than 1 per cent. per annum. . . .

Our experience during the twenty-one years under review has, I consider, conclusively proved that coco-nuts are suitable for cultivation over large areas in the lowlands of the colony; that local varieties of coco nuts yield very heavy crops of medium-sized nuts on relatively heavy clay soils on the coastlands, whilst on lighter lands similar varieties produce much larger-sized nuts; that there can be no doubt that the colony is emphatically a coco-nut land, and that, as such, there are in it practically unlimited areas of land very suitable and readily available for coco-nut cultivation.

THE BARBADOS-ANTIGUA EXPEDITION FROM THE STATE UNIVERSITY OF IOWA.

The following article by Professor Nutting, who was in charge of the expedition, appeared in *Science*, September 6, 1918:—

The Barbados-Antigua Expedition from the State University of Iowa returned to New York on August 1, with all its members in good health, and without mishap of any kind.

There are nineteen persons in the party, nearly all of them instructors or graduate students from the State University of Iowa. Their object was not only to secure collections in marine zoology, entomology, and geology from a region in which little work had hitherto been done; but also to study the living forms in and around the islands visited, and thus supplement the future more intensive work based on the collections secured.

In both Barbados and Antigua the colonial authorities provided excellent quarters for the party, and adequate laboratory facilities in government buildings, and both officials and private citizens aided the enterprise in every possible way.

At Barbados dredging was accomplished at about one hundred stations, working down to over 150 fathoms, this was rendered possible by the use of a fully equipped 27-foot launch provided by Mr. John B. Henderson, of Washington, who accompanied the expedition, and who will report on the collections of Mollusca, of which many new or rare forms were taken.

Practically all species taken with the dredge or tangles will provide new locality records extending the known geographical range. The fauna, while not so rich as that of the western end of the Antillean chain, or the continental shelf of the Florida Keys, is of remarkable interest from a distributional standpoint, while a number of new forms will interest the systematist. The apparent scarcity of certain groups abundant in the western parts of the West Indies, such as the Asteroidea, was something of a surprise. As is usually the case in a region of growing corals, the coelenterate fauna was most conspicuous, but there seemed to be a remarkable scarcity of medusae. Indeed the pelagic fauna was rather poor.

Shallow water forms, on the contrary, were remarkably abundant and interesting, furnishing ample material for laboratory work and study of forms in situ. Some probably new forms of actinians and corals were secured. Balanoglossus was found in the sand near our laboratory on Pelican Island.

By employing a native diver many species were secured at depths from 3 to 9 fathoms. Some remarkably fine corals and alcyonarians were thus obtained. The use of fish-pots and native fishermen resulted in a fairly complete set of reef fishes which would not otherwise have been secured. Very few deep-water fishes were taken.

Many gorgeously coloured comatulics were dredged, but the pentacrinoids were represented by but a single Rhizocrinus. The serpent stars were, as usual, very abundant, and a number of simple-armed basket-fish were found. Crustacea were, of course, particularly numerous, perhaps the most interesting being small macrourans secured by breaking up old coral heads.

At Antigua the party was given quarters at the old dockyard at English Harbour, a formidable naval base in Nelson's time. Here the conditions were entirely different from those at Barbados. The trade-winds were so strong and constant during our stay that little dredging could be accomplished, and the entire time was devoted to shallow-water forms in English Harbour, Falmouth Harbour, and Willoughby Bay. These waters were over mud bottoms; the shores, however, being varied in the form of mud flats, mangrove swamps, sand beaches, and rocky shores. Here were found a veritable wealth and variety of aquatic forms, a great majority being different from those secured at Barbados.

Tube-dwelling worms, some of great size and beauty, were perhaps the most striking feature; tunicates and holothurians coming next in point of abundance both in individuals and species. Among the Mollusca, a great quantity of beautiful Murices were collected off the sea wall, where they seemed to be devouring the soft parts of a bivalve (Perna) that was attached in great quantities near high-water mark. A very large Chætopod, called locally 'sea scorpion', was found to bore through a heavy Livona shell, making a hole as smooth as a drill.

Large and wonderfully beautiful anemones of several species were abundant, particularly in Falmouth Harbour, as well as the finest colonies of Pennaria that I have ever seen. The Echinoidea were well represented, mostly by well-known forms.

One small spatongoid was found to live buried from 6 to 12 inches under the sand. Among the Crustacea, a very large land-crab, with orange brown carapace and purple and white chelae, was perhaps the most striking form.

At both Barbades and Antigua extensive collections were made in the field of geology by Professor A. O. Thomas. Mr. Henderson made a practically complete collection of land mollusks, while Mr. and Mrs. Dayton Stoner did faithful and successful work in the entomological field in which they were very materially aided by both the local and Imperial Departments of Agriculture. The field of botany had no professional representative in the expedition; but considerable collecting and field work was done by Mr. Willis Nutting. A fine series of two species of bats was secured at Antigua.

As already indicated, Mr. John B. Henderson will report on the Mollusca. The reef fishes will be reported on by Dr. Barton W. Evermann. Professor W. K. Fisher will attend to the Asteroidea and Holothoroidea, while the writer will probably report on the Hydroida and Aleyonaria. The other groups have not as yet been assigned.

A large series of excellent photographs, including moving picture films was secured by Mr. Maurice Ricker official photographer of the expedition

EDITORIAL NOTICES.

Head Office — Barbados.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies — Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

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Typist	Miss B. Robinson.
Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number exposes some fallacies which are commonly believed on the subject of general education.

Under Insect Notes, on page 330, will be found an article on insects damaging cotton in Arizona.

In connexion with the interest being taken in cultivation of the castor oil plant, a disease affecting this plant in some parts of the United States is described under Plant Diseases page 334.

On page 327 will be found a notice of the scientific expedition from the Iowa State University to Barbados and Antigua in the earlier part of this year.

Castor Seed.

India practically has the monopoly of the world's export trade in castor seed. A large quantity of oil is made for home consumption, and a surplus exported. These exports, according to the *Tropical Agriculturist* for June 1918, are gradually dwindling down, owing to the crude methods adopted for expressing the oil, and the wholesale adulteration practised by the small dealers. Besides this, the mineral oils are ousting castor oil as a lubricant.

The cake is exported chiefly to Ceylon as a manure for tea, etc. In India it is one of the most valuable of oil cakes as a manure, especially for crops of potato and sugar-cane. The cake has been used in India also as fuel for stationary engines, and gas has also been obtained from the cake for lighting railway stations. It is stated, however, as being unable to compete with cheap coal for fuel.

The oil, apart from its use in medicine, is chiefly employed as a lubricant on the Indian railways; it is also used for dressing leather, and in the process of turkey-red dyeing.

Manufacture of Orange Wine in the West Indies.

Owing to uncertainty and high cost of procuring Madeira and French wines, the manufacture of orange wine promises to become quite an industry in some of the West Indian colonies. This beverage has been manufactured in small quantities for local consumption for a number of years both in Jamaica and Trinidad, but for the reason above stated, its manufacture is now being considerably extended, in quantities large enough to meet the increased local demands.

A correspondent in the *Commercial Review* of British Guiana, September 1918, referring to the matter claims this product to be on a fair level, both in taste and bouquet with ordinary Madeira or French wines of its age; in colour it approaches that of a sherry, but manufacturers state that it can be made to assume a rich deep port colour without the use of injurious chemicals. This appears to be an industry that might well be encouraged in all colonies in the West Indies where large crops of oranges are grown, but where only a comparatively small proportion of the fruit is exported to foreign markets, in view of existing high prices, and the difficulty in obtaining imports in usual quantities under prevailing circumstances.

Pigs and Soil Grubs.

In the July number of *Revista de Agricultura Comercio y Trabajo*, the official organ of the Department of Agriculture of Cuba, there is an interesting account of the life-history of one of the beetles, the grubs of which attack the roots of sugar-canes.

Cognate species, if not identical, are among the recognized insect pests of many of the West Indian islands, and one of them has proved a serious menace to the sugar-cane industry in Mauritius. The grub described seems to be causing uneasiness in some dis-

tricts in Cuba, and the article referred to suggests means of combating its attacks. One suggestion, which although often made before, seems worth drawing attention to again, is the employment of pigs to root out and devour the grubs. Immediately the canes are cut in infested districts it is advised that the field be ploughed, and that pigs be turned in after the plough. They will, it is stated, almost infallibly nose out and devour every grub.

A few years ago there was a bad outbreak of the grubs of a brown hard-back (*Lachnosterna* sp.) on one of the sugar-cane estates in Antigua. The manager of this estate has recently informed us that the damage done to the last cane crop by these grubs has been very slight, and he attributes the control of the pest to the employment in the way suggested in Cuba of a small herd of pigs.

Agriculture in Antigua.

Mr. A. E. Collens, the Superintendent of Agriculture in Antigua, reported under date September 23, that the cane crop generally, which up to the beginning of the month presented a parched and stunted appearance was commencing to recover, owing to the rain which had fallen later on, especially on September 10 and 14. Where steam ploughing and implemental culture have been practised, the canes had been able to survive the drought, and looked healthy and regular, though low. The deep ploughing, followed by the implemental cultivation, has enabled the soil to retain sufficient moisture to ensure the vitality of the plants.

A kerosene tractor with plough attachment—the 'Titan', manufactured by the International Harvester Co. U. S. A.— has been lately imported by one of the estate owners, and has been doing good work on moderately heavy soil. It is stated that on such soils it is capable of ploughing 2 acres a day at a very moderate cost. Owing to the scarcity of draught oxen, machines of this type ought to prove of great use. Another planter had just imported an Avery oil-tractor of 12-14 horse power, for the double purpose of ploughing and haulage. This machine had not yet been at work.

The cotton crop had suffered a good deal from the drought, but the plants still look green and healthy. The Agricultural Department was able to obtain adequate supplies of Paris green and London purple, the prompt use of which has controlled attacks of the cotton worm. The picking of cotton for the new crop has begun.

Some estates in Antigua have received supplies of a new type of nitrogen manure, known as 'nitrogenous meal' or 'acidulated leather.' This is manufactured from leather waste treated with sulphuric acid in order to render it soluble. Mr. Collens draws planters' attention to the fact that this fertilizer is only suitable for use on soils that contain a sufficient quantity of lime. He suggests that it may be found valuable in the treatment of so called 'gall-patches'.

Agricultural Returns of England and Wales, 1918.

A leaflet published by the Board of Agriculture and Fisheries on August 27, 1918, states that the returns of acreage and live stock collected on June 4 show that the total arable area in England and Wales this year is 12,398,730 acres, representing an increase of 1,152,620 acres or 10 per cent. over the arable area of 1917. This is the largest area returned for the past twenty years. The area under permanent grass is 14,588,900 acres, a decrease of 1,246,470 acres on the year. The total area under crops and grass thus amounts to 26,987,630 acres, as compared with 27,081,480 acres in 1917.

The greater part of the grass-land ploughed up has been placed under wheat and oats. The increase in the area under wheat is 638,260 acres, or 33 per cent. and the total now under this crop amounts to 2,556,740 acres, which is the largest since 1884. Oats this year cover 2,778,980 acres, the largest on record, and 520,070 acres (23 per cent) more than last year. The other corn and the pulse crops also show increases; barley by 42,000 acres, rye by 45,000 acres, beans by 40,000 acres, and peas by 19,000 acres. To these cereal areas there have to be added 141,580 acres under mixed corn now for the first time separately distinguished, the returns of such crops having previously been divided between the various corn crops, according to the kinds grown.

The total area under corn and pulse (wheat, barley oats, rye, beans, peas, and mixed corn) this year thus, amounts to 7,481,000 acres, as compared with 6,035,000 acres in 1917, an increase of 1,446,000 acres, or 24 per cent., and the largest area under corn since 1879.

Potatoes have been increased by 125,850 acres, or 25 per cent., and the total area (633, 840 acres) is much the largest on record.

War Use of Nutshells and Fruit Stones.

Under war conditions many uses have been found for hitherto wasted products. One of the latest of these is the employment of fruit stones and nutshells in making the charcoal which is best adapted for use in the masks which protect our soldiers from the fumes of the gas used by the enemy. The charcoal thus produced very greatly increases our soldiers' chances of life in gas attacks. *The Times* in its issues of July 25 and August 10, 1918, draws attention to this matter, and commends the idea of 'Stone and Shell Clubs', the members of which undertake to make every effort to collect stones from fresh fruit as well as from prunes and dates, and also the hard shells of coco-nuts and other hard nut shells, and to forward them in parcels when collected to the proper quarter.

It is pointed out that the material is required for the safety of the soldiers in the trenches, and therefore the effort to avoid its waste, and to secure an adequate supply is a patriotic duty at this time.

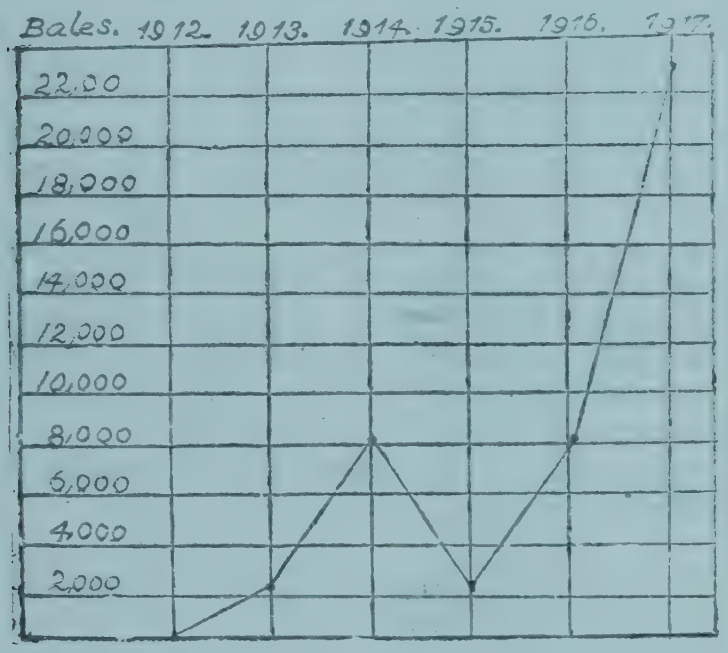
INSECT NOTES.

COTTON INSECTS IN ARIZONA.

The increase in the cultivation of cotton in Arizona during the past six years has been very considerable, and the insect pests of that crop have naturally been more numerous and more troublesome with the extension of the area planted in it. The report of Dr. A. W. Morrill, State Entomologist, in the Ninth Annual Report of the Arizona Commission of Agriculture and Horticulture for the year ended June 30, 1917, which has just been received, contains an interesting section on the pests of cotton observed in Arizona during the year, from which the following notes are taken:—

It is seen that during the season under review, and for the past six years the cotton crop has been increasing, while for the previous three years the amount of planting of fruit trees had greatly decreased.

The development of the cotton industry is indicated by the following diagram which shows the amount of the annual crop for the State in the years 1912-17.



A new species of thrips was discovered attacking cotton during 1917. This has been given a manuscript name (*Thrips arizonensis*). It was fairly destructive on a moderately large scale, and the statement is made that if this insect continues to appear as a cotton pest it will be necessary to spray for its control.

A small beetle (*Myochrous longulus*, Lec.) caused serious injury to young cotton in one section, where 500 acres were twice replanted, and the seedlings each time completely destroyed. The cotton had to be abandoned in this area, and another crop was planted. The following is quoted :—

'In the affected fields not a trace of cotton was to be seen above the ground. Search in the soil of the bed rows revealed the presence in great numbers of the above species. The adults were seen in many cases still in place on the underground portion of the stems of the decapitated seedlings, but were also seen commonly feeding on the subterranean succulent stems of arrowweed, trailing mallow, and *Bacharis* sp.

'All affected fields were in crop for the first time, and prior to clearing the land had (last season) supported an almost pure growth of arrowweed (*Pluchea sericea*). Owing to the ease which the Myochrous beetles were found on the arrowweed stems it would appear probable that this is the native host of the pest. It is reasonable to suppose then, that following the eradication of the arrowweed the beetles transferred their attention to the young, tender cotton plants which were readily at hand.'

This insect is known to occur on Mesquite (*Prosopis juliflora*) and has been reported to attack young cotton in California. It is likely that this beetle is found throughout all cotton sections of Southern Arizona. (In the West Indies the small beetle *Myochrous armatus* is known as the corn leaf beetle, a minor pest of sugar-cane and Indian corn; an account of this insect was given in the *Agricultural News*, Vol. XV, p. 26 January 15, 1916.)

The light-brown grape-leaf beetle (*Colaspis brunnea*, Fab.) which is common in the Salt River Valley, ordinarily causing perforations in the leaves of the grape, was found in considerable numbers on cotton in 1917. The injury to the leaves was of the same nature as that inflicted on the grape leaves. (*Colaspis fastidiosa*, a related insect which occurs in St. Vincent also attacks cotton leaves.)

The cotton worm (*Alabama argillacea*, Fab.) was not found in the cotton fields during 1917, making two years in succession when this insect was not found. At one time it was feared that the cotton worm would live over the winter in Southern Arizona, and that the infestation would start early in the year. Experience has so far shown that the status of the cotton worm in Arizona is about the same as it is in the South Eastern States. It is thought that a moderate infestation of this insect would be very beneficial to the cotton fields of Southern Arizona, where the tendency is toward too rank growth of plants.

The cotton boll worm (*Heliothis obsoleta*, Fab.) was more destructive in the cotton fields during 1917 than at any time since cotton-growing has been taken up on a commercial scale in the Salt River Valley. In one field it was estimated that 30 per cent. of the bolls had been destroyed by this pest. In another field this insect was responsible for a rather unusual form of injury to cotton. This injury consisted in the attack on the cotton stalk about 6 inches from the growing tip. The young caterpillars entered the stems at the leaf axils, and tunnelled the stems for some 2 or 3 inches, which killed the stalk from the point of attack to the tip. In one section it was estimated that 40 per cent. of the stalks were affected in this manner. This injury is credited to the boll worm, on the evidence of finding one boll larvae in an injured stalk. This specimen was parasitized, several specimens of one of the flesh flies (*Sarcophaga helicis* Town.) being reared from it. The total damage was not great from this form of twig boring, and in fact the damage by the boll worm in the Salt River Valley was estimated at less than 5 per cent.

The cotton leaf perforator (*Bucculatrix thurberiella*, Busck.) was more abundant than in previous seasons. The grasshopper (*Melanoplus differentialis*) completely destroyed a few acres of cotton, but was quickly and completely checked by the use of poison baits. The cotton stainer (*Dysdercus albidiventris*, Stal.) mentioned in a previous report was not common in 1917, and did no appreciable damage. In the section where these insects were most destructive the previous year, it was with difficulty that a few specimens could be found. Tarnished plant bugs (*Lygus pratensis oblineatus* Say and *L. elisus* var. *hesperus*, Knight) were plentiful and destructive in the Salt River Valley in 1917. In one field it was estimated that 90 per cent. of the cotton squares were destroyed, mostly by these insects. This was on July 24, and though the plants were from 4 to 5 feet in height very few bolls had set. Soon afterward the bugs left the field, and a small crop was produced.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Mr. J.C. Moore, Superintendent of Agriculture, states that during the month of August the work on the Experiment Station consisted chiefly of routine work on lawns, roads, and plots. Some onions were harvested from sets planted in June. Apparatus and materials for spraying thrips on cacao were supplied to several planters. The following distribution of plants was made from the Experiment Station: limes, 400; coco-nuts, 787; grafted mangoes, 3; ornamental plants, 2. Besides, there were sent out 35lb. of Sea Island cotton seed, and 3 packets of other seed. With regard to staple crops, Mr. Moore regards the coming cacao crop as promising to be fair on the whole, although thrips are troublesome in places. Spraying for the control of this pest is being proceeded with on several estates. The lime crop is reported to be normal. The spice crop is good, and high prices are obtained, a large shipment having been recently made. At the South end of the Island the Sea Island cotton, ratooned from 1917, suffered much from the dry weather. June sowings elsewhere are said to show promise. Some further sowing in September is contemplated. The weather during August was very hot; the rainfall at Richmond Hill was 6·55 inches.

MONTSERRAT. Plant distribution during the month of August was as follows: Bay plants, 350; pigeon peas, 6 lb.; sword beans, 1lb.; bread-and-cheese seeds, 2lb.; Lima beans, 4 lb.; and red Bougainvillaea, 8 plants; black eye peas, 3 packets. The reaping of the first crop of cotton on the breeding plot in the experiment station was practically completed, the yield being in the neighbourhood of 200 lb. of lint per acre, with prospects of a good second crop. In the Botanic Station six distillations of bay leaves were made, including two further tests with sea-water in the boiler.

Mr. W. Robson, states that the rainfall has been inadequate for the cotton crop of the island as a whole, and is of opinion that unless there is a much larger second crop than usual, the returns cannot come up to the average of previous years. The Cotton Stainer Ordinance and the Ordinance of 1918, relating to the close season for cotton and enforcing the destruction of the host plants of this pests have been passed.

A short lime crop is anticipated on account of the drought. The total rainfall registered for the month at the Grove Station was 4·65 inches.

VIRGIN ISLANDS. Mr. W. C. Fishlock, Curator, writes to say that, owing to drought and scarcity of labour, little beyond ordinary routine work could be attempted in the Experiment Station. Plant distribution consisted of 56 lb. of cotton seed. Consequent on the drought, the conditions of cultivation throughout the islands was poor, and there was no progress to report.

Rain fell in measurable quantity on fourteen days of the month, the total fall recorded at the station being 1·97 inches, as compared with 4·12 inches, the average for the previous seventeen years. A cyclonic disturbance passed apparently north-east of Tortola on August 23. The storm was either a moderate one, or its centre far away, as the usual heavy rains on the fringe of such storms were not experienced.

AGRICULTURE IN BARBADOS.

The rainfall for September was regular and continuous. Fair days were few, and they were sincerely appreciated. From the 4th to the 8th, from the 9th to the 13th, and from the 18th to the 23rd there were summer days, but practically on every other day rain fell in varying quantities. On several occasions there were general rains of over an inch, while in some districts there were heavy downpours. In the northern, north-western, and southern parts of the island the rain gauge record is above the average, while in every part of the island the total was equal to the figures of the most favourable years.

The plant canes everywhere continue to make excellent progress, and many fields are now being stimulated by the recent application of sulphate of ammonia. The length of cane is very satisfactory, and we cannot remember having seen any field in which there is any sign of disease.

The ratoons, like the plant canes, have had very favourable weather, and, generally speaking, are developing fairly well. They are thick, but not as forward as we should like to see them.

Apart from the condition of the soil necessary for the production of healthy ratoons, planters have also to consider whether the seedling grown is capable of producing satisfactory crops both as plant-canes and ratoons. It would appear that a more liberal treatment will have to be the order of the day, if the seedlings best suited for ratooning are to be able to keep up their vigour for first and second ratoons. We are glad to say that planters are beginning to lose their faith in the inexhaustibleness of the soil for a protracted period of ratooning. We should also like to see entirely discontinued the practice of forcing back for plant canes fields from which three or four crops have been previously reaped.

Tillage has been retarded during the past fortnight, and it has been possible to weed only spasmodically. Pecking, cane-hole digging and the gathering of material for manurial purposes were proceeded with fairly regularly, but it was too wet even for forking.

Potatoes are more plentiful in Bridgetown and the leeward parishes, but in the centre of the island there is still some scarcity of this vegetable. The price in Bridgetown a few days ago was 84 cents per 100 lb.

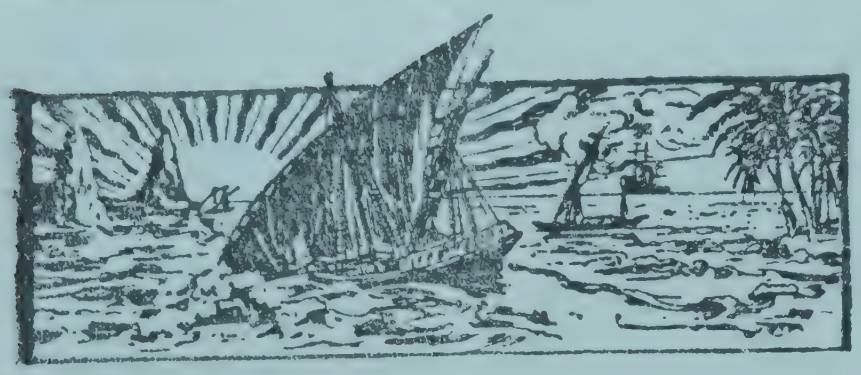
Indian corn is being sold at 7s. per bushel, and hucksters are selling the meal at the same price as at the date of our last report—4 cents per pint.

The yam crop is developing well. If a favourable October assures a good return, the coming crop ought to be a satisfactory one. A few new yams have been sold at the rate of 4 lb. for 10 cents. (The Barbados *Agricultural Reporter*, October 5, 1918.)

DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture has left Barbados for St. Vincent with the object of paying an official visit to that Colony. Sir Francis Watts is expected to return to Barbados in about two weeks time.

Mr. W. Nowell, D.I.C., Mycologist on the staff of the Imperial Department of Agriculture, has left for Grenada, at the request of the Government of that island, for the purpose of investigating a disease of coco-nuts.



GLEANINGS.

As is well known Zanzibar and Pemba supply most of the cloves used in the world. From the Annual Report on the Agricultural Department of the Zanzibar Protectorate for the year 1916 which has just been received at this office it appears that the export of cloves had risen from £12,783,149 lb. in 1910 to 25,425,454 lb. in 1915, although in 1916 it dropped to 20,282,816 lb.

Large quantities of pigeon peas (*Cajanus indicus*) are consumed in India, under the name of 'dhall'. The dried peas are soaked over night and then dried in heaps from three to six days in the sun, being stirred from time to time. When thoroughly dry they are ready for the grind stone which removes the outer skin and splits the seed. They are then in a marketable condition. (*Tropical Agriculturist*, April 1918.)

The Times for May 16, 1918, records the success of an experiment for making paper from sawdust. An Aberdeen newspaper had been printed on paper which contained a large percentage of sawdust. The experimental reels were in every respect satisfactory and that newspaper has been the first in the United Kingdom to prove the practical utility of sawdust paper, the output of which promises to have a far-reaching effect on the paper scarcity problem.

By cutting off the supply of synthetic dyes from Germany, the war has led to a marked revival in the demand for natural dye-stuff, especially indigo and fustic, used respectively for the blue and khaki cloths required for naval and military uniform. The output of indigo has greatly increased both in India and Java, the chief sources of supply, and fustic, which is obtained chiefly from Jamaica, Honduras, and Brazil has been exported from Jamaica in greatly increased quantities. (The *Field*, August 24, 1918.)

In a review of a book on malaria in Macedonia among British troops it is stated in *Nature*, July 18, 1918, that malaria in Macedonia has been responsible for a much higher degree of invaliding than wounds have. The infection is so widespread that even units at the base and on the lines of communication are liable to the disease. The difficulty in dealing with the breeding grounds of anopheles in 'No Man's Land' at the front is responsible for the greater prevalence of malaria amongst the troops in that area. An outline of the general system observed by the military medical authorities in dealing with the problem shows that the measures adopted are both systematic and thorough

Mr. R. R. Bennett, of the British Drug Houses, Ltd., in the course of a lecture on 'Progress on Pharmaceutical Products', said that the total number of vegetable drugs which have become unobtainable owing to the closing of enemy countries is remarkably small, but the cultivation of drug-yielding plants should be prosecuted in the United Kingdom to the utmost, and that the resources of our Colonies should be developed to an increasing extent for the supply of vegetable drugs which can not be grown at home. (*Nature*, August 22, 1918.)

Very considerable numbers of odoriferous plants are being experimentally cultivated in the United States at the present time. In this connexion it may be noted that government experiments conducted in Florida and Wisconsin had shown that an acre planted with horsemint (*Monarda punctata*) will yield about 40 lb. of essential oil. It has been calculated that the commercial production of this oil can be made to show a profit of about $16 per acre. (*Perfumery and Essential Oil Record*, *July* 23, 1918.)

With suitable labour and a fair market the South Pacific Islands, according to the report of the Interstate Commission on the trade of the South Pacifics offer a wide and promising field for cotton cultivation. In New Caledonia and the New Hebrides the French have already shown how promising is this field from the point of view of production and consumption. The variety of cotton cultivated is *Gossypium peruvianum*, a coarse, strong-grained cotton, largely used by spinners for mixing with woolen thread. (The *Board of Trade Journal*, August 22, 1918.)

Commenting on the report on foreign trade of Ceylon in the Blue Book for 1917 the *Board of Trade Journal*, August 29, 1918, notes that for the first time rubber takes its place at the head of the table, while tea, which was the principal article of export previously, has the second place. There was a strong demand for coco-nut oil but the average price of this article was lower than in the previous year. The quantity of cacao exported was practically the same as in 1916 but here again the article showed a considerable drop in value.

The *Bulletin of the Italian Chamber of Commerce* in Shanghai draws the attention of Italian spinners to the advantage of importing cotton from China in view of the increasing shortage of the raw material. The average chineese production is 2,200.000 bales (of 500 lb.) per annum, of which 1,000,000 go to the Chineese spinners and 200,000 are exported. Japan takes about 100.000 bales, the United States 50,000, and the United Kingdom 50,000. As regards price it should compare favourably with American cotton, c.i.f. Genoa.

An article by Dr. G B. Mason, in *United Empire* for August 1918 gives the following interesting comparison of area and population between the British West Indian colonies, Newfoundland and New Zealand taken from the Colonial Office list for 1917. The total area of the West Indies exceeds that of New Zealand and is more than twice that of Newfoundland. The total population is more than eight times that of Newfoundland and more than twice that of New Zealand being over 2 million. The population per square mile is more than three times that of Newfoundland and nearly twice that of New Zealand.

BAT GUANOS OF PORTO RICO AND THEIR FERTILIZING VALUE.

Deposits of bat guano are especially common in the tropics and in sub tropical regions, and their fertilizing value has never been investigated thoroughly. Generally they are of small size, consisting of from a few to several thousand pounds, and they usually occur in limestone caves. Results and analyses of an investigation to determine the fertilizing value of the bat guano of Porto Rico comprise *Bulletin No. 25* of the Porto Rico Agricultural Experiment Station. This material is roughly divided into fresh bat manure, decomposed guano, and leached or phosphate guano.

The analyses and tests reported show the great variation in different bat guanos, in respect to their content of the fertilizing elements, and the availability of the elements. Bat guanos, except fresh bat manure, cannot therefore be regarded as a specific fertilizer in the same sense as modern commercial fertilizers, or even as the old Peruvian guano.

The fresh bat manure, however, is a fairly definite material in appearance, composition, and availability of its phosphoric acid. It is a complete fertilizer, high in nitrogen, medium in phosphoric acid, and low in water-soluble potash. The water-soluble potash, of course, is all available, the phosphoric acid is of high availability (little less than that of acid phosphate), and the nitrogen is in part immediately available and in part slowly available. This material is somewhat similar to tankage, differing in containing potash, in having part of its nitrogen more available and part less available than the nitrogen of tankage, and in containing, as a rule, more immediately available phosphoric acid.

The monetary value of fresh bat manure averages about $33 per dry ton. It should be analysed where practicable, as it is somewhat variable, especially where not freshly gathered.

All other guanos, excepting the fresh material, are incomplete fertilizers, lacking either potash, nitrogen, or both. All bat guanos, however, contain phosphoric acid. As a rule the uncontaminated guano increases in phosphate content as the nitrogen content diminishes. Most bat guanos are to be regarded as phosphatic fertilizers containing a small amount of nitrogen, although some are merely phosphatic fertilizers. They ought to be reinforced by the addition of other materials before being used for certain crops on certain soils.

Most bat guanos, but not all, are to be classed with the low-grade fertilizers, either because of a low percentage of the fertilizing elements, or because of a low availability of the nitrogen or phosphoric acid. This does not mean that they are capable of utilization only under certain conditions, although they can be used more advantageously under some conditions than under others. As guanos contain a variety of other substances besides nitrogen, phosphoric acid, or potash, some persons have an idea that they ought to have a peculiar fertilizing value because of their very complexity. This is not true for the most part, although a few of the bat guanos, in common with the old Peruvian guanos, are particularly effective for certain conditions, because of having their nitrogen present in different degrees of availability.

Most guanos can be mixed with any of the commercial fertilizers without loss of availability in the mixture. A few guanos containing carbonate of lime should not be mixed with sulphate of ammonia or acid phosphate. A test for carbonate should be made by observing whether the guano effervesces with acid, before mixing a guano with such materials. If it is desirable to use a guano containing carbonate with sulphate of ammonia, the sulphate of ammonia should be applied to the soil first, and later the guano incorporated with the soil. On the other hand, a few guanos contain considerable ammonium salts, and these should not be mixed with basic slag, as the free lime of the slag will liberate the ammonia.

Guanos can also be used to supplement stable manure, as stable manure is relatively deficient in phosphoric acid. A phosphatic guano can be advantageously added to the compost heap as it is being formed. By making the material more compact, this will tend to conserve ammonia.

Low-grade phosphatic guanos can be mixed with coffee hulls and pulp, which contain a small amount of potash. Doubtless the acetic acid produced in the fermented hulls and pulp will aid somewhat in rendering the phosphates more available. Experiments, however, have not been conducted in support of this conclusion. Composting soluble phosphatic guanos with waste or decaying citrus fruits and pine-apples, or with refuse from pine-apple canneries would doubtless be quite effective in increasing the availability of the phosphoric acid in such materials.

In applying the guanos, it should be borne in mind that most of them contain little water-soluble material. Consequently they will be most effective when well and evenly mixed with the soil.

When fresh bat manure, or guanos high in nitrogen and organic matter are to be used for young pine-apples, the material may be safely applied in the crown, as is done with dried blood. Even though these guanos should contain considerable ammonia and nitrate, there will be little danger of injuring the plants, as the bulky nature of the fertilizer prevents dangerous concentration of soluble salts in any place. Only fresh bat manures, or guanos composed chiefly of organic matter, should be applied in this way, as other guanos, like soil, will tend to smother the plant.

Compounded with other materials, on the basis of their analysis and efficiency to make the proper formula, guanos can be used for any crop. There are some specific features about the guanos, however, which make them especially good for long-time crops.

All the guanos contain a considerable portion of their nitrogen in an insoluble and relatively unavailable form. To this part of the nitrogen a value only one-fourth that of the ammoniacal and nitrate nitrogen was given. It is nevertheless probable that practically all this insoluble nitrogen will become available in time. It should therefore be regarded as of considerable value for a long-time crop, or at least for the permanent enrichment of the soil.

Work is at present under way to determine the relative efficiencies of the standard phosphatic fertilizers on the different soils of Porto Rico. When this work is completed, quantitative data should be available concerning what phosphates are best for the different soils. From the general knowledge available on the subject, and from the availability tests reported here, it appears that the bat guanos should be particularly valuable phosphatic fertilizers for acid soils and for non-calcareous clay soils. On neutral sandy soils they should show an efficiency equal to that assigned them in this report, but not an enhanced efficiency. On strongly calcareous soils many guanos, in common with bone meal and rock phosphate, will have their efficiency lowered much more than that of acid phosphate. A few guanos, however, appear particularly good for calcareous soils, their efficiency being less affected by liming than any of the other phosphates. Thus far no analytical method has been found which will tell whether or not the efficiency of a guano will be affected by liming.

PLANT DISEASES.

GRAY MOULD OF CASTOR BEANS.

Considering the increased attention which is being given to the cultivation of the Castor Oil plant an article on the above subject by H. E. Stevens, which has been issued as *Press Bulletin, No. 296* of the University of Florida Agricultural Experiment Station, is reprinted below, as of interest in connexion with this crop.

A fungus disease that has appeared on the castor bean within the last two weeks is causing serious injury to the crop in many regions of the state. It is a gray mould that attacks the fruit spikes in various stages of development. The unopened flower buds, flowers, and nearly mature pods are attacked by the fungus. In some cases from 50 to 90 per cent. of the plants in a field are affected with the disease. Rain and shady conditions seem to favour a rapid spread of this mould.

APPEARANCE.

The disease is at once recognized by the grayish, webby mass of fungus growth on the affected heads. In well developed cases from one-half to three-fourths of the affected head will be enveloped by a gray, webby mass more or less powdery in appearance. Pods and flowers in a head that are killed by the fungus become brown and covered with a dusty gray, powdery mass which contains countless numbers of spores. The disease appears to start at one point and spreads rapidly until the entire head is affected. The fungus also attacks the stem of the fruit spike and flower stems causing at first a dark, watery rot. The affected part soon dies, turns brown and becomes dry.

The first appearance of the disease is marked by a dark coloured spot or stain usually on one or more adjacent pods. This spotting sometimes appears first on the stem of the fruit spike or on the pod stems. The affected tissue is found to be rotted and watery. No fungus growth is visible at this stage, and the remainder of the pods or heads appears green and normal. Three or four days later a fourth or half of the head may be enveloped with a grayish growth, and all parts covered by the fungus are killed.

CAUSE.

The disease is caused by a fungus which appears to be a new species of Botrytis. Specimens were sent to Mrs. F. W. Patterson, Bureau of Plant Industry, United States Department of Agriculture who reports the fungus as an undescribed species of Botrytis. Very little is known of its habits at present and it does not seem to have been reported on the castor bean before. Under moist conditions the fungus produces spores (seed) in countless numbers in the webby growth enveloping the affected heads. These are readily scattered by the wind and insects and infect other fruit heads.

The fungus is very active under moist shady conditions and during periods of rain and cloudy weather it may become very destructive, especially where beans are closely planted and are making vigorous growth.

CONTROL.

The rapidity with which this fungus has developed and spread within the last two weeks, and the nature of the castor bean plant, offer little encouragement for an easy method of control. Where it is widely scattered through a field very little can be done to protect the fruit heads that may develop during the rainy season. After the dry season comes on the disease will probably cause small loss.

In fields where the disease is just appearing and only a small number of heads are affected, further loss may be prevented if immediate steps are taken to suppress it. All affected fruit heads should be cut off and put directly into a pail of kerosene and carried from the field and burned. Plants from which affected heads are cut should be thoroughly sprayed with Bordeaux mixture, 4-4-50 formula, to kill spores that have lodged on the leaves and stems. The flower and fruit heads on all plants in the vicinity of diseased ones should be thoroughly sprayed with Bordeaux. An area of 50 to 100 feet beyond all diseased areas should be sprayed and inspected frequently for new outbreaks.

PLANT QUARANTINE.

In the *Monthly Bulletin of the State Commission of Agriculture*, California, June 1918, appears a note, which is reproduced below. The old Latin tag would seem very appropriate to our West Indies in this matter. *De te fabula narratur.*

From Australia comes the report that citrus canker has made its appearance in the commonwealth. True to tradition, the press does not hesitate to jump on the horticultural officers, and lay the blame for allowing the importation at their door.

This is in a large measure to be expected. Speaking in the abstract it should be stated that there are many aspects of such problems that are seldom brought to the notice of the public.

The assertion is ventured that there are horticultural officials who have had a chance to wear themselves out trying to squeeze from a reluctant legislature funds for the purpose of providing a means of preventing the introduction of some plant pest or disease that may be causing consternation in some other part of the world, and which it is realized will sooner or later be brought to their shores. Nor is the legislature entirely to blame. Such bodies as a rule are generally composed of individuals largely ignorant of the bionomics of insect pests and plant diseases, without training in the estimation of evidence in this line, and withal unable to appreciate the extent or imminence of danger which may be anticipated from this source. The responsibility may often be traced farther back to the fruit growers themselves who, with full knowledge of the true significance of the menace, wait for someone else to take the initiative until the eleventh hour, when the pest in question appears, and their chance has vanished. This attitude is particularly reprehensible, as they must surely understand fully that whatever happens they will be the losers.

As a result of this combination of circumstances pleas for preventive rather than remedial measures too often receive a deaf ear. Whatever the reason, the results are always the same. In tracing the course of introduced plant pests and diseases it is an unwritten law that the government which has failed to take necessary precaution in providing adequate means to prevent the introduction of undesirable alien plant pests and diseases, sooner or later, but nevertheless surely, has an opportunity to dig down into its coffers to the extent of about one hundred times which the amount of a proper insurance against this class of undesirable aliens would have cost.

It may seem a far cry, but perhaps some day it will be recognized that any insect or pathogenic organism which utilizes as a host some particular plant, no matter in what part of the world that host plant may exist, without proper protective measures becomes in this day of modern transportation facilities a potential pest throughout the entire region where such a plant may be grown.

California has had an opportunity to view the case in its different aspects. The price of her knowledge has been alternative between destruction of her citrus industry, and the annual expenditure of large sums of money to keep under control a host of these introduced enemy aliens, brought into her midst before the potentialities of such things began to be appreciated. Viewing her experiences in retrospect, she now purchases insurance against their further introduction by a judicious system of quarantine and a trained inspection service exceeded by none, and equalled by few. It is believed that a few pages taken from the experiences of our state will well repay the trouble.

THE IMPERIAL INSTITUTE'S INVESTIGATIONS IN THE DEVELOPMENT OF EMPIRE RESOURCES.

At a recent meeting of the Executive Council of the Imperial Institute, presided over by Lord Islington, information was submitted concerning a large number of investigations in which the Institute has been engaged during the past few months. The subjects of these investigations have been mainly new or little known raw materials, which have been brought into prominence by the war.

The general scarcity of paper, in spite of the recent allocation of additional shipping for its importation, continues to invest the discovery of new sources of supply with great interest for manufacturers and traders. Though the present problem is largely one of shortage of ship's tonnage, the steady growth of the world's demands for paper renders it imperative that new paper-making materials should be brought into use, if prices are to be kept down after the war. Among the materials examined at the Imperial Institute during the present summer have been grasses from South Africa, the Federated Malay States, Australia, and St. Helena. Samples of 'Tambookie' and similar grasses from the Pretoria district gave a high yield of pulp of good quality, capable of conversion either into excellent brown paper or (after bleaching) into white paper. Lalang grass—which grows abundantly in the Malay States, and hitherto has been so little esteemed that on the rubber plantations it is regarded as a troublesome weed—was found on investigation at the Imperial Institute to compare favourably as a paper making material with Algerian esparto grass, though not quite so good as Spanish esparto. Bamboo grass from the Northern Territory of Australia came up to about the same standard. All these grasses would be suitable for utilization in their countries of origin for the manufacture of either pulp or paper, and full reports on their properties as paper-making materials have been drawn up by the Imperial Institute for the Governments concerned.

The shortage of shipping is limiting not only the imports of raw materials into the United Kingdom, but the exports of manufactured articles, with the result that the outlying portions of the Empire have a new and compelling motive for seeking among their own resources the wherewithal for the supply of their needs. For example, the restrictions on the export of galvanized iron have stimulated interest in several colonies in the suitability of the local clays for the manufacture of bricks, tiles, etc., for building purposes. The Government authorities of Northern Nigeria have been experimenting in this way, and the Imperial Institute, after a large number of technical trials with samples sent to the Institute, has been able to suggest various methods of improving on the results obtained from the first experiments in Nigeria.

A sample of clay received from Tasmania, and described as kaolin (china clay) proved on examination to be a fire clay, suitable in the crude state for the production of high-grade refractory bricks. This enhances its importance in view of recent metallurgical developments in Australia, and further investigations have been recommended. The washed clay is of a white colour, and if mixed with other suitable materials could be utilized for the manufacture of porcelain and pottery.

BREEDING NEW SEEDS.

Addressing a meeting of the Agricultural Seed Association of the United Kingdom at the Cannon-Street Hotel on July 15, on the aims and objects of the National Institute of Agricultural Botany, which it is proposed to establish at Cambridge, Mr. Lawrence Weaver, Director of Supplies, Food Production Department, according to *The Times* of July 16, 1918, said that we stood at the threshold of a new reconstructive era for agriculture. The labourer was certain of a living wage; the farmer was fairly certain that for a good many years to come he would receive an adequate return for his produce; the scientist had the knowledge that his efforts would be better supported by the Government; and the trader and distributer were satisfied that business would be better organized largely by their own efforts.

The proposed Institute of Agricultural Botany, he thought, would command the confidence of the farmer and of the seed trade. As a foundation for the trust fund he had received £10,000 down from Sir Robert McAlpine, and a further £1 000 a year for five years. Four others had given £4,000 altogether. The Millers' Association had resolved to raise £5,000, and the Corn Merchants' Association had agreed to open a subscription list.

The Institute was not intended to be educational, but its purpose was to introduce new breeds of seeds, and to improve existing varieties. He desired it to be regarded as a grand co-ordination in the improvement of seeds and plants. It would not compete with the seed trade or control it, but would help it, making use of trade channels for distribution. At Cambridge there was already a plant breeding institute under the direction of Professor Biffen, who was one of the great assets of British agriculture. He had, however, been enormously hampered by lack of funds and helpers, and the chief function of the new Institute would be to take over and carry on, on a commercial basis, the valuable efforts of Professor Biffen.

Mr. G. P. Milne, the chairman, announced further donations amounting to £9,350, and a resolution was carried welcoming the scheme in the interests of British agriculture and of the seed trade.

Mr. Weaver said that he would call a meeting of the subscribers to the trust fund, and invite them to adopt a draft deed governing the Institute. The Board of Agriculture would provide all the money for building and equipping the seed testing station, which would form part of the Institute.

Subscriptions in the room brought up the total from the Seed Trade Association to over 10,000 guineas.

MARKET REPORTS.

London.—The West India Committee Circular, August 22.

Arrowroot—No quotations.
Balata—Venezuelan Block, no quotations; Sheet, no quotations.
Beeswax—No quotations.
Cacao—Trinidad, 90 -; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 4/6 to 5/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—9½*d*.
Rubber—Para, fine hard, 3/0½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., October 4.

Cacao—Venezuelan, no quotations; Trinidad, no quotations.
Coco-nut Oil—$1·46 per gallon.
Coffee—Venezuelan, 15c. per ℔..
Copra—$7·25 per 100 ℔.
Dhal—$11·50 to $12·00 per bag.
Onions—$10·00 per 100 ℔.
Peas, Split—$8·00 per bag.
Potatoes—English, $4·00 per 100 ℔.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs Gillespie Bros. & Co., July 12.

Cacao—Caracas, 13c.; Grenada, 13c.; Trinidad, 12¾c. to 13c.; Jamaica, 11½c. to 12c.
Coco-nuts—Jamaica selects, $42·00; Trinidad $40·00; culls, $20·00 to $21·00 per M.
Coffee—Jamaica, 9¼c. to 11c. per ℔.
Ginger—15½c. to 16½c. per ℔.
Goat Skins—Jamaica, 85c.; Antigua and Barbados, 85c.; St. Thomas and St. Kitts, 85c. per ℔.
Grape Fruit—Jamaica, importation prohibited.
Limes—Importation prohibited.
Mace—40c. to 45c. per ℔.
Nutmegs—27c.
Oranges—Importation prohibited.
Pimento—6¾c. to 7c. per ℔.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·055c Molasses, 89°, 4·998c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., August 29

Arrowroot—$12·00 per 100 ℔.
Cacao—$12·00 to $12·50 per 100 ℔.
Coco-nuts—$48·00 husked nuts.
Hay—$3·00.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoor, no quotations.
Sugar—Dark Crystals, $5·00.

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Rats and Mongoose in the West Indies.

THE mongoose was introduced into the West Indies in the early seventies of the last century, and within a space of about ten years had spread to all the islands where it is now known to occur, namely, Jamaica, Trinidad, Tobago, Grenada, St. Vincent, Barbados, St. Lucia, Antigua, and St. Kitts-Nevis. It does not occur in Dominica, Montserrat, Barbuda, the British Virgin Islands nor Carriacou. The mongoose is found in Cuba and Santa Cruz.

In 1907 it was reported in a meeting of the Jamaica Agricultural Society that a correspondent in Mexico had asked to have some mongoose sent to him in order that the species might be established in that country. The Secretary of the Society was not able to comply, because of a lack of suitable shipping facilities, but if the individual interested in importing them was persistent it is likely that he has been successful, and that before this time the mongoose has become established in that country.

Rats, which seem to occur wherever man exists, were to be found in these islands from very early times. The black rat and the brown or grey rat, both of Old World origin, have been brought to the West Indies with the shipping. The 'cane piece' rat of Jamaica appears to be of uncertain origin. It is said to have been larger than either of the other two, and distinctly marked.

Previous to the introduction of the mongoose the injury to the sugar-cane by rats was so great that rat-catching was a regular part of the routine of many, if not of most, sugar estates. Not only did rats cause much injury to the canes, but they were a source of direct expense. It has been estimated that in Jamaica the losses to the island as a whole amounted to as much as £100,000 per annum, while some estates paid as high as £300 to £400 per year for rat-catching. The rat catchers were a source of further expense, for they often pulled down walls in order to catch the rats, and these walls had afterwards to be repaired.

The introduction of the mongoose into Jamaica was found to be of great value to the island, a saving

of some £45,000 per annum being estimated as the direct and almost immediate effect of the reduction in the number of rats due to the activities of the mongoose, and, in all the islands where the mongoose was introduced for the purpose of killing rats, the value of the introduction was appreciated at once; rats were much reduced in numbers, and the losses in sugar-canes and the expenses of rat-catching were saved to a large extent.

After a time, some ten to fifteen years, complaints began to be made that the mongoose had failed to kill off all the rats but had taken heavy toll of many ground-nesting birds, lizards, and toads, and had caused much loss of poultry and eggs. Later, the apparent increase of insect pests of crops was charged to the account of the mongoose, which having upset the balance of nature by killing off many insect-eating forms, had thus provided for the increase of undesirable insects.

In Jamaica, this phase passed in a short time, and for the past fifteen years or more the opinion seems to have prevailed in that colony that the mongoose is of sufficient benefit more than to offset its depredations.

In Trinidad, Barbados, Antigua, and St. Vincent, on the other hand, the mongoose has been, and still is considered an unmitigated pest by a very large proportion of the people.

It should be stated, however, that in 1911 a Commission appointed by the Governor of Barbados to enquire into the usefulness or otherwise of the mongoose as a rat killer, came to the conclusion that the mongoose was of value in keeping the rats in check, and that the mongoose destruction law ought to be repealed. This was not done, and the law is still in force. It may be remarked, however, that the Select Committee, which in 1917 reported in favour of mongoose destruction, found that the impression prevailed that the law of 1909 was not operative, and in consequence practically no money was being claimed as bounty for mongoose heads.

In the islands where the mongoose does not occur, there are laws against its importation. Such Ordinances occur in Montserrat, Barbuda, the British Virgin Islands, Dominica, and Carriacou.

The mongoose was introduced into St. Lucia for the direct purpose of combating the serpent, the Fer-de-lance, and it has been so successful as a snake killer that up to the present no serious complaints have been heard of its being a nuisance in that island. The mongoose in St. Lucia lives principally on the lower, more open lands in the neighbourhood of dwellings and cultivations, and preys upon poultry to some extent. The result is that very few serpents appear in these, the inhabited, districts.

The Select Committee (1917) of the House of Assembly, Barbados, was of opinion that the destruction of the mongoose ought to be continued; but did not refer to the destruction of rats.

Rats are not only pests of sugar-cane, but of every crop; and all stored food products and many household articles suffer from their depredations. They destroy books and papers, gnaw through the woodwork of buildings, and often dig out the interior of walls, and undermine cement floors and masonry foundations. They are the cause of epidemics of disease, especially plague, which being a rat-borne disease, is communicated to human beings by the bite of the rat flea.

At the present time the situation with regard to rats and mongoose appears to be as follows. In Jamaica it is realized that rats are still a serious pest, and that any reduction of the numbers of their enemies would immediately be followed by an increase in the numbers of rats, and in the damage done by them. Consequently, the feeling in that colony appears to be that the mongoose is doing more good than harm. Vigorous efforts are being made to reduce the numbers of the rats, although there seems to be no government action in the matter.

In Trinidad the mongoose is looked upon as being all harm and no good, at least, that the harm done by it is so much in excess of the good that the latter is hardly taken into account at all. In St. Vincent and Antigua the same opinion seems to prevail.

In Barbados the feeling at the present time on the part of that portion of the community represented by the Select Committee of the House of Assembly appears to be that the mongoose should be destroyed, without regard to any useful purpose it may have served or may be expected to serve. In 1911, however, the Commission on mongoose reported that on account of its value as a rat killer the mongoose ought not to be destroyed. Probably the real attitude toward the mongoose and rat question in Barbados is somewhere between that of the Commission of 1911 and the Select Committee of 1917. At times the rats are very destructive—then the mongoose ought to be encouraged; at other times the depredations of the

mongoose are noticed, and attacks of insect pests experienced, and then the feeling is that the mongoose should be exterminated.

The situation in Grenada is shown by letters from the Colonial Secretary and the Agricultural Superintendent, to the effect that the mongoose was not a pest in that Colony, and that there were no laws or Ordinances dealing with its control. These letters were in reply to a letter addressed in 1917 by the Trinidad Government to the Government of Grenada and to the Governments of other West Indian Colonies as to the status of the mongoose, and the steps being taken to control it.

The introduction of the mongoose into these islands has very seriously upset the balance of nature, and it is likely that the introduction of the rat did the same. These two animals now form such a part of the faunistic economy that the complete extermination of either one would be likely to cause as great an upset in the balance of nature as their introduction has done. Exterminate all the rats, and the mongoose would be likely to reflect the new condition by increased ravages on other sources of food. Exterminate the mongoose, and the rats would without doubt soon become as serious pests as ever they were in the past.

It appears to be quite certain that the mongoose has influenced the abundance of ground-nesting birds, and of insectivorous animals such as toads and lizards, and that rats have taken to nesting in trees in order to escape from them. Perhaps the rat, now that it climbs to escape the mongoose, is more destructive than formerly to the eggs and nestlings of many of our tree-nesting birds.

In all these ways the mongoose may be said to be responsible for the decrease in the natural enemies of the insect pests attacking our crops; but it must be remembered that there were serious insect pest epidemics in the West Indies before the introduction of the mongoose.

The problem of rat and mongoose control involves the question whether this shall be in any way the duty of Government, or shall be left to private energy and enterprise. The course taken by the several Governments, consisting in paying a bounty for rat carcasses, was not eminently successful in the control of rats. After long years of such effort the mongoose was introduced to aid in the matter.

The evidence appears to show that both the rat and the mongoose can be controlled on any given property and in any given district by individual effort. If this is so, concerted action of individuals over large areas, or throughout an entire colony, would reduce this undesirable animal to small numbers.

It would appear, then, that the first step in such control would be individual action, concerted and unified through the Agricultural Societies or similar bodies. When the efforts of individuals are carried as as far as they can be, the Government may be asked to help in matters of advice and assistance in regard to poisons, traps, and methods to be employed to extend and increase the effect of the work of the individual.

THE BENEFIT OF ADDING FRESH BULLOCKS' BLOOD TO FOWLS' RATIONS.

Many experiments undertaken in various Experimental Stations in the United States have amply proved that when an addition of animal food, rich in protein, is made to the ordinary food rations of laying hens, there is marked increase in the number of eggs they produce. Such additions as meat, milk, dried blood, etc., invariably lead to a greater production of eggs.

Following out these results, Dr. Rafael de Castro and Senor Pedro Benitez Quirch have recorded in the *Revista de Agricultura, Commercio y Trabajo*, August 1918, the result of an experiment carried on by them in Cuba, as to the effect on the egg production of hens, obtained by adding a certain portion of raw bullocks' blood to the daily ration.

Two lots of thirty hens and six cocks each, of the single comb White Leghorn breed, were placed in separate enclosures, marked 1 and 2.

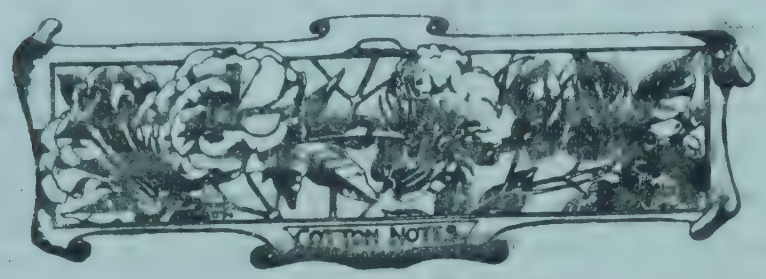
Both lots received daily a ration consisting of 4 lb. of a mixture of oats, crushed maize, sun-flower seeds, and barley, but for this was substituted, after the fifth week, the same weight of food composed of 2 parts of maize to 1 part of oats. In addition to this, lot No. 2 received 2 lb. of fresh bullocks' blood mixed with their corn, this blood being brought daily from a slaughter-house. Both lots were supplied with as much water as they would drink, and were given from time to time equal quantities of fresh garden stuff, and also equal quantities of calareous grits. The rations were placed daily in feeding boxes at 3 p.m.

The experiment was begun on February 3, and continued until April 6, a period of nine weeks, with the following results.

The total number of eggs produced by lot 1 was 530, while lot 2 produced 682 eggs.

The cost of the food of each lot was $14·45, and in the case of lot 2, an additional 40c., the cost of the blood. That is to say, this additional 40c. produced 152 eggs.

It is not to be wondered at that the experimenters claim that they have clearly proved that the addition of a certain portion of fresh bullocks' blood to the daily ration of laying hens increases largely their egg production, and this at a trifling cost, because the substance may be obtained cheaply and easily in any place in the neighbourhood of a slaughter-house.



COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended September 7, 1918, is as follows:—

ISLANDS. Since our Annual Report of August 3, the market has remained quiet and unchanged, with only a limited inquiry, but no sales or receipts.

The unsold stock of old crop is still held on a basis of Fully Fine 72c., of which there is left unsold about 325 bales bright cotton, and the balance more or less stained.

The new crop will not be marketed until October Consequently the market will not open until then.

GEORGIAS AND FLORIDAS. There have been sales in Savannah during August aggregating about 600 bales on a basis of average Extra Choice 68½c, taking such lots as were ordered sold by the owners, the buying being on account of the Northern Mills.

The stock is generally held higher, say, average Extra Choice 69c. to 70c., and a sale has been recently made of 100 bales Fancy at 71c., on account of a Southern Mill. This sale has caused Factors to be firmer in their views, at least temporarily.

No new crop cotton has been put on the market yet, but there should be some receipts during the next fortnight. However, the planters throughout Florida have at some meeting passed resolutions to delay ginning until October.

CROP ADVICES. In Carolina and along the coast, the promise of a month ago has deteriorated in consequence of intensely hot and dry weather, and estimates are reduced to 7,000 to 8,000 bales.

In Georgia and Florida, we have to confirm our advices in our Annual Circular of August 3. The boll weevil is doing considerable injury, and the continued hot weather has caused the plants to shed and to rust. Crop estimates for these States still range from 60,000 to 75,000 lb.

THE OLONA, A VALUABLE HAWAIIAN FIBRE.

The ever-increasing demand in the world's market for fibres gives interest to the following extract from an account of a possible valuable source of supply of fibre of the finest quality by Vaughan McCaughey, of the College of Hawaii, published in *Science*, September 6, 1918.

The Hawaiian people formerly made use af a considerable range of fibre plants. Some of these were brought by the natives from the South Pacific, others were discovered in the new island home. The paper mulberry (*Broussonettia papyrifera*) is an excellent example of a fibre plant widespread in the Pacific region. From its copious bast was made the typical 'kapa' or bark-cloth of Polynesia. 'Olona (*Touchardia latifolia*, Gaud.), on the other hand, is wholly confined to the Hawaiian Islands; the genus is monotypic and endemic. The ancient Hawaiians undoubtedly discovered the valuable fibre of this plant at a very early time. They were intimately familiar with the local flora and its economic utilization. The olona is mentioned in many of the old songs and legends.

Special interest is attached to the olona fibre, as it is generally recognized to be the strongest and most durable fibre in the world. No other fibre is recorded to exceed it in these two important characteristics.

The natural habitat of the olona is the lower and middle forest zone, lying on the mountains between elevations of 800 to 1,000 feet. It is strongly hygrophytic and shade-loving; it never occurs naturally in the open or in dry sections. The favourite habitats are deep, cool, gloomy ravines, or moist slopes that are well screened by forest cover. The olona belongs to that ecologic section of the Hawaiian flora that luxuriates in the dense moist shade of the montane forests. It occurs in little patches or thickets here and there in the forest, but is nowhere abundant. It does not form continuous stands; reproduction is not vegetative, but apparently always from seed. In any one spot the collector is not likely to find more than a few score of individual plants.

The Hawaiians formerly cultivated the olona in a primitive manner. They did not prepare the land or plant seed, but merely searched out good patches of the wild plants. Such a patch was cleared of any obstructing vegetation, not disturbing, however, the large trees which shaded the plants. If the olona plants were too crowded they were thinned out. The old plants were pruned so as to give a number of young, straight shoots.

At irregular intervals, as convenience or necessity dictated, the grove was visited and the crop harvested. This process consisted in cutting all the long, straight shoots that had reached a diameter of about 1 inch. The bark of such shoots was rich in bast fibres, and these were of maximum length. Six feet was an average length. The bark was carefully stripped from the wands, in one or more pieces, packed into rolls or bundles, and carried down to the settlements on the lowlands, where the final operations were performed.

A suitable situation was found along a stream or irrigation ditch. The bundles of bark were opened out in the shallow running water, where they were allowed partially to macerate. This required several days; then the long strips were removed from the water, and the remaining pulpy matter was scraped from them while still wet. The scraping was performed on a long, narrow, hardwood board, specially devised for this purpose. The prepared fibre was carefully dried and rolled into cordage of varions sizes.

Among the Hawaiians it was put to a great variety of uses. All fishing-lines and nets of the best quality were invariably made of olona, because of its high resistance to the action of salt-water. Olona lines and nets which have been in more or less constant use for over a century are almost as good as new, and are handed down from generation to generation as precious objects. Most of the natives are very unwilling to part with any of their fishing-gear that is made of olona.

This fibre not only partakes of all the best characteristics of this genus, but is superior to any other of its members, producing the best of all fibres known at the present time. The three dominant features are:—

First—The great tensile strength. The strength of olona is estimated as about three times the strength of commercial Manila. The statement is made that olona is about eight times as strong as the hemp (*Canabis sativa*). So far as I can gather, this great strength is due to the unusual length of the cell in proportion to its width.

Second—Its great resistance to deterioration in salt-water. A ball of olona fish-line, the Hawaiian owner of which stated that it had been in their family, and in constant use, for over fifty years, has been examined, and the fibre was still in an excellent state of preservation.

Third—Its pliability, and thus its adaptabi'ity for spinning by hand. Fishing-lines and nets made from this fibre by expert Hawaiians present an appearance of so uniform a calibre and twist that it would lead one to believe that the fibre had been made by the most intricate machinery.

A fibre with these characteristics should be exploited to the fullest measure. The extraction of this fibre is not a difficult process.

The key to the situation lies in transforming this plant from its wild state to a cultural form. When this is done, the world will be in possession of a new fibre, having a greater tensile strength, weight for weight, than any other fibre known.

SEA-EGGS AS FOOD.

In the editorial of the *Agricultural News* August 24, 1918, it was pointed out that besides fish in the true sense of the word, there were other marine products which might be more largely utilized as a source of food in these West Indian islands.

Among these and among the easiest of utilization is the echinoderm, known in the West Indies as the sea-egg. The species, which in Barbados is quite an important source of food, is known scientifically as *Hipponoe esculenta*. It is found on coral grounds in all the tropics of the Western Atlantic, from the coral reefs of Florida down to Brazil. Two other species of echinoderms are used as food in other parts of the world. *Echinus esculentus*, the sea urchin of England, fairly plentiful on the western coast of Scotland, is eaten, at least by the fishermen in those parts, according to the *Cambridge Natural History*. An allied species in the Mediteranean is regularly exposed for sale in the markets of Naples under the name of 'frutta di mare'.

When we say that these animals are used for food, it has to be remembered that only the genital organs are so employed. These are found lining the inter-ambulacral plates of the sea-eggs, five in number, in the form of a branching system of tubes. When they are filled with sexual cells ready for emission, they attain a considerable size, as large as the middle finger of a man's hand in many instances, and constituting a very large portion of the bulk of the whole animal. It is in this condition that the sea-egg, or rather its roes and milts, is best for food.

It is to be regretted that no accurate investigation has been undertaken as to whether the sea-egg matures its ova and spermatozoa only at certain periods of the year, or all the year round, according to the growth of individuals. Some time ago it was found that the sea-egg supply was seriously falling off in Barbados. The Government of the island obtained a scientific report on the matter from Dr. Duerden, the Curator of the Museum of the Institute of Jamaica. He advised artificial propagation of the spawn, and certain prohibited areas, wherein fishing should be unlawful at any time. It must be said that the sea-egg is protected in Barbados, it being unlawful to take sea-eggs from the end of April to the beginning of August. But, according to local beliefs, it is just in August and September that the 'fullest' sea-eggs are taken. This is however leading us away from our subject—the use of sea-eggs as food.

In spite of the fact that *Hipponoe esculenta* abounds throughout these islands, only in Barbados is it utilized as a food. Although it is very hard to obtain an estimate of the value of purely locally used foodstuffs, it was computed, according to the evidence given before the West Indian Royal Commission in 1898, that a large proportion of £4,000 was to be placed to the credit of this industry.

The method of taking sea-eggs is simple. The fishermen employ either small rowboats, or, in calm waters, only large wooden trays which they push before them. When on the 'grounds', the boats or trays are anchored by a stone attached to a rope, and the fishermen proceed to collect the sea-eggs by diving for them, sometimes in water as deep as almost 3 fathoms. They take with them a wide-meshed open-mouthed bag, and usually a hook of thin iron hoop to remove the sea-eggs from their attachment. These are placed in the bag and brought to the surface and placed in the boat. As soon as the fishermen have obtained a sufficient load, the boats are brought to land.

The second stage then begins. Sea-eggs of a diameter of 4 or 5 inches are carefully opened by breaking the shell around the mouth so as to preserve the shell fairly whole, but to allow of the contents being easily removed.

Every other part of the animal, except the genitalia adhering to the shell, is washed out in the sea. These shells are then filled with the genitalia taken from the rest of the shells, which are not so carefully broken. The next process is a partial cooking of the filled shells. This is usually done by steaming them over a fire of brush wood on the beach in kerosene tins at the bottom of which some water is placed, with sticks so arranged as to prevent the shells themselves touching the water. In this condition they are hawked about all over the island of Barbados, forming a nutritious and cheap food.

The following recipes for further preparation of sea-eggs for the table are taken from a book by the late Mrs. Graham Yearwood, of Barbados: —

1. SEA-EGG PIE

Four large shells of sea-eggs steamed, ¼ lb. of butter-some bread crumbs, ¼ lb. of onions, some chopped, some sliced, half a wine glass of sherry, 2 tablespoonfuls of olive oil. Put in a pie dish, sprinkle with bread crumbs, and bake.

2. SEA-EGG PIE.

Beat 6 eggs and add ½ gill of biscuit crumbs, ¼ lb of butter, 4 good shells of sea-eggs, salt and plenty of onion. Mix well, put in a pie dish, sprinkle with crumbs, put pats of butter on, and bake.

3. SEA EGGS.

Two or three shells of sea-eggs steamed, ½ quart tin of tomatoes or fresh ones skinned and mashed, ¼ lb. of onions, ¼ lb. of butter, salt and pepper, and a little meat gravy. Fry the sea-eggs with the onions, and mix with other ingredients, lay in a pie dish, throw over ½ a wine glass of sherry. Cover with mashed English potatoes, baste with white of egg, and bake.

It may be said, however, that sea-eggs are very tasty morsels when eaten plainly fried or steamed with simple seasoning of salt and pepper to taste.

THE GO-TA-NI BEAN.

The following information concerning a new kind of bean, called 'go-ta-ni', is abstracted from the *Journal of the Royal Society of Arts*, Angust 23, 1918. This would appear to be a valuable bean, and possibly one which would prove worthy of trial in these West Indian colonies:—

Attention is drawn by the United States Consul at Mombasa to the production in East Africa of a new kind of bean, called the 'go-ta-ni', which is described as yielding two crops per annum, with high percentage of albuminoids and oil, while the moisture is low. The owner of the estate at Changamwe, where the experiments have been made, calls the product a cross between the Madagascar butter bean and the *Canavalia eusiformis*. It is credited with a yield of 22 cwt. of dried marketable beans per acre during the 1916 season. The *Mombasa Times*, in an article on the subject, gives the following details:—

'The period for maturing is five months. The plant is a standard perennial, and attains an average height of 2 feet 6 inches. It is extremely hardy, being both a drought and insect resister. The foliage is dense, and if planted 1 foot apart in drills, the rows being 3 feet apart, it entirely prevents the growth of weeds. At this distance 63 lb. of seed will plant an acre. The seed readily germinates. When the plants are 6 inches high, the ground should be hoed, after which they require no attention until the crop comes off. Planted between young coco-nut palms, coffee, sisal, etc., they do away with at least two cleanings per year, while their foliage offers excellent shade and protection to the young plants.

'The pods attain a length of 14 to 16 inches, and yield fourteen to sixteen perfect beans, which are $\frac{3}{4}$-by $\frac{1}{2}$-to $\frac{1}{2}$-by-$\frac{3}{8}$ inch in two dimensions, and $\frac{1}{2}$-inch thick. They are white externally, the hilum being brown. The interior is a pale yellow, and they possess an agreeable flavour. On a sample sent to England £18 per ton was offered. This works out at £19 16*s*. per acre every six months. As the crop can be picked, thrashed, and bagged on the land, it should prove one of the most profitable products grown in the colony.

'The advantages of a perennial legume of this nature are manifold, and cannot be over estimated. For planters it reduces the tremendous cost of cleaning to a minimum, and brings the plantation into an almost immediate paying concern. It gives a good return in six months with very little outlay.

'There is nothing in the chemical analysis to indicate that the material is unfit for food; on the contrary, the beans should provide a nitrogenous food of a concentrated kind, the protein content being nearly equal to that of dried beef. No prussic acid has been detected in the macerated product, nevertheless, if the material has not been used before as food for human beings or animals, it would be advisable to ascertain by experiment that no poisonous substance is present.'

THE ROLE OF WATER IN A COW'S RATION.

It is fairly generally known that some dairymen claim that if the amount of drinking water given to a cow is limited, the body temperature is raised, the composition of the milk modified, and the percentage of fat especially increased. In order to verify this assertion, a series of experiments was undertaken in the United States of America on the effect of watering cows at different intervals with varying quantities of water, on the following factors: amount of food consumed, digestibility of food, quantity and composition of milk, composition and quality of butter fat, body temperature and physical condition of the cow. The experiment was divided into three periods, separated by a period in which the ration was normal. In the first period the animals were watered every twenty-four hours (an average of 61·65 lb. per head), in the second period every sixty hours (an average of 51·20 lb. per head), in the third period with half the normal ration of water (40·00 lb. per head). The following were the results obtained, according to the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, June 1918:—

Food consumed.—When the cows are watered once in twenty-four hours instead of two or three times, there is a slight decrease in the total amount of food taken and in the quantity of milk produced, but this second decrease is not proportionate to the first. During the thirty days of the experiment the animals lost an average of 11 lb. per head. This loss was much greater during the second test (17 lb.), and the third (95 lb.) per head, on an average.

During the periods in which the cows received a full ration of water at long intervals, the expected decrease in milk production was not obtained. If the slight decrease in the amount of food consumed and the loss in weight be considered, it must be concluded that cows can utilize the water stored in their systems for milk production and other functions. When the cows only received half the normal quantity of water, there was a marked decrease in the amount of hay consumed, milk produced, and in body weight.

Digestion of rations.—The coefficient of digestibility was increased in each of the tests in which the intervals between watering were lengthened, and in those in which the cows only received half the normal ration of water. This increase in the coefficient of digestibility is particularly marked in the case of crude fibre. Cows watered once in twenty-four hours digested 55 per cent. of crude fibre as compared with 54 per cent. digested by the control animals watered three times a day; cows watered once in sixty hours digested 71·07 per cent. of fibre as against 55·7 per cent. by the control animals, and those receiving half a ration of water digested about 2 per cent. more than the control animals.

These results show that to obtain the most efficient digestion of food, it is wise not to water the animals too abundantly at feeding time, or immediately before or after a heavy meal.

Effect of the quantity of water ingested, on the quantity and composition of the milk—In all the tests, the composition of the milk and butter fat remained absolutely unchanged. It is for this reason that a cow receiving insufficient water goes dry without there being any modification in the composition of her milk. Frequent watering has little influence on the quantity of milk produced. When the normal water ration was reduced by half, the milk yield was reduced a little at the beginning, this reduction increasing as the experiment continued, till it was about a quarter. There is no doubt that the cows would have gone dry if this ration had been continued.

Effect of water on the body temperature of the cow.—When the cows were watered every twenty-four hours the body temperature was lowered by the fraction of one degree Fahrenheit fifteen minutes after watering. With intervals of sixty hours, the temperature dropped 2°F. The minimum was obtained one to one-and-a-half hours after watering (130 lb. of water per head). The temperature of cows receiving half the normal ration of water was 1°F. higher

than when they received a normal amount, but there was no increase in the fat content of the milk.

In conclusion it may be said that keeping dairy cows in milk in hot sheds, blanketing them, and withholding water in order to raise the fat content, is very dangerous to their health.

Physical condition of the cows.—The abnormal conditions brought about by withholding water were nervousness, gauntness, and high body temperature. When the animals were watered every six hours, and when they received half the normal ration of water, a larger amount of energy was required to accomplish the body functions.

Chief functions of water in a dairy cow's ration.—The results of the experiments led the authors to the following conclusions: A good dairy cow probably requires more water than any other domestic animal. Water dissolves food (for this reason the more food an animal eats, the more drink it requires), distributes it to the different parts of the body, and removes the waste products. The authors showed that more than 12 per cent. of the total water drunk is eliminated through the skin in winter in the shed, and 27 per cent. in August. On an average, 15 per cent. of the water drunk passes into the milk (in good milkers this percentage is higher; in one of the experiment animals, among which there were no choice cows, this percentage was 24).

COFFEE CULTIVATION IN BRITISH GUIANA.

In the course of the interesting address delivered before the Royal Agricultural and Commercial Society of British Guiana, portions of which have been reproduced in the last two issues of this Journal, Professor Harrison described the past history and the present condition of the coffee industry in the colony. Coffee has played such an important part as a crop of the West Indies in the past, and may perhaps do the same in the future, that we are glad to reprint below the Professor's remarks on the subject:—

We are aware that in the eighteenth century and in the earlier part of the last century Guiana, and especially Berbice, was celebrated for the high quality of coffee produced; and that at the time of the cessation of slavery, circumstances beyond the control of the planters necessitated the gradual abandonment of its cultivation. For instance, in 1821 the export of coffee from the colony was 124,086 cwt.; in 1833 it had shrunk to 51,860 cwt.; in 1840 to 30,000 cwt.; in 1845 to 4,400 cwt.; whilst in 1847 it had disappeared from the list of exports. In 1896 locally grown coffee had again become an article of export, but only to the extent of 63 cwt., whilst 1,763 cwt. of coffee was imported, its value being upwards of $27,600.

Sir Daniel Morris, in his subsidiary report to the West Indian Royal Commission, laid great stress on growing coffee, as being, next to rice, the most promising of all subsidiary products. He pointed out that for coffee-growing 'British Guiana can offer exceptional advantage in soil and climate, and in proximity to suitable markets. These are most important elements on which to base the existence of large and successful industries.'

The following table illustrates how far his advice has been followed, and with what results as regards the extension of the area planted and the exports and imports of coffee:—

Quinquennial periods.	No. of acres (British) under cultivation.	Coffee exported, lb.	Coffee raw and prepared, imported, lb.
1894-1898	No records	5,600	262,700
1896	" "	*7437*	*197,476*
1899-1903	718	5,580	284,160
1904-1908	1,370	17,900	181,370
1909-1913	2,660	115,200	83 200
1914, 1915 & 1916 (3 years only)	4,466	304,000	55,200
1917	4 *953*	*266 864*	

In 1917 the export would have been far more than doubled were it not for the lack of shipping facilities, as in 1916 over 501,000 lb. were exported.

The marked extension in coffee-planting during the period under review has been mainly, if not entirely, with the Liberian variety. Both Arabian or so-called Creole coffee, and Liberian coffee grow with exceptional vigour, whilst the former is singularly free from disease.

In 1897 it was already recognized that Liberian coffee grew very well indeed in many parts of the colony, and that wherever it flourished it was very prolific. It has since been found that at times and in certain places the difficulty is to restrict its bearing propensities sufficiently to prevent the tree either permanently injuring itself or even dying from the effects of over-production. Climatic conditions on lands situated at some distance from the coast-line, and on the lands along the lower reaches of the rivers are the most favourable for the growth of Liberian coffee.

There are still plenty of openings for the development of plantings of coffee, the best of which, perhaps, are on the lands bordering both banks of the Berbice River along its course from about 30 to 150 miles from its mouth, whilst similar plantings in the North West and in the Pomeroon Districts would be of almost equal promise.

Whilst progress in this Colony with regard to coffee-planting during the past ten years appears to us to be marked, our coffee industry is practically in a deplorable state of stagnation in comparison with that of our neighbours in Surinam. There, not only has the area planted with Liberian coffee been greatly augmented, but coffee is being grown on excellent cultural lines, such as are followed by very few indeed of our planters, with the result that on plantations there—plantations having from, say, 400 to 800 acres of Liberian coffee in full-bearing—returns of coffee per acre are attained which to growers having only local experience, are almost incredible. I do not know of any coffee-plantation here that can point to fields which yield year after year crops of from 1,500 to even 2,000 lb. of cured coffee per acre. Not alone have the Surinam coffee-planters materially extended their cultivation and vastly increased their yields per acre, but by the establishment of coffee pulping, drying, cleaning, and grading machinery of the very best modern types they have brought their product from being one of the lowest valued types of coffee on the market to one occupying a very prominent position among the highest grades of coffee in the market of New York. Unfortunately there are not any coffee plantations here of areas sufficient in the opinions of their owners to justify investments in the latest types of coffee machinery, and what is equally important, the employment of managers capable of getting the best results from the best equipped factories. I am satisfied that there is a certain remedy for this condition. It is the installation of co-operative coffee factories in each of the more important coffee-producing districts of the colony.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies — Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* / Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

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Typist	Miss B. Robinson.
Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

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†*Provided by the Imperial Department of Scientific and Industrial Research.*

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NOTES AND COMMENTS.

The editorial in this number discusses the position of rats and mongoose at the present time in the West Indies.

Under Insect Notes, on page 346, an article will be found concerning the weevils which attack sweet potatoes and yams, and another describing the injury done by termites to sweet potatoes.

On page 341, an article on the use of sea-eggs as food, will doubtless be found of interest.

The great possibilities connected with the forest industries of British Guiana form the subject of an article on page 347.

Onions in Dominica.

Mr. E. J. Seignoret is continuing his expirements in growing onions at Spring Hill estate in Dominica, which were noticed in the *Agricultural News*, June 1, 1918.

Mr. J. Jones, Curator of the Botanic Gardens, Dominica, has recently forwarded two samples of onions grown by Mr. Seignoret from sets raised from Teneriffe seed imported in November 1917. Sample No. 1 contained six onions grown from sets planted in July. These six onions weighed 4 oz., with an average diameter of 1½-inches. Mr. Jones says that owing to drought this planting did not do very well. Nevertheless, the onions forwarded, though small, were sound, and apparently would keep well.

Sample No. 2 consisted of a single onion grown from a set planted in August. The weight of this onion was 1½-oz., and its diameter slightly over 2 inches. Mr. Jones says that this lot did really well. The onion forwarded was an excellent specimen.

Mr. Seignoret has not planted any sets in September, but is again planting this month.

It is hoped that Mr. Seignoret will continue his experiments in onion cultivation in Dominica. The results already obtained are very interesting, for they show that onions can be produced to advantage at several seasons of the year under certain conditions in Dominica.

In the notice referred to above in the *Agricultural News*, June 1, 1918, allusion was made to Mr. Seignoret's experiments in the local production of onion seed. With reference to this, the following, extracted from the *Journal of the Department of Agriculture of Victoria*, Australia, April 1918, may be of use to him or any other experimenter in the same direction:—

'Following are brief instructions for saving some biennial root crops for seed: Onions—the onion bulb should be pulled a little earlier than when used for food, and should be cured with the tops left on where there is a free circulation of air, but protected from direct sunshine and rain.'

It will be remembered that the onion takes two years to mature seed. These cured bulbs should then be replanted, and in the following season they will produce seed. The seeds turn black before they are ripe, but the heads should not be gathered until there is danger of loss of seed from scattering. The heads should then be cut from the stalk, and dried.

Green Manure Crops in Southern California.

The following summary of the results of experiments at the College of Agriculture Experiment Station, Berkeley, California, recorded in *Bulletin* No. 292 of the University of California publications, will probably be of interest to growers of citrus crops in these West Indian islands.

Green manure crops have had a marked effect on citrus trees. The trees on the plot where legume green manures have been annually turned under are superior in every way to those similarly fertilized, where

no leguminous green manure has been used. Green manuring has resulted in a 30-per cent. increase in size of tree. The total yields at the age of ten years were 68 per cent. greater on the green-manured plot. Not only was more fruit produced but the proportion of fancy and choice fruit was larger. Green manuring had a marked effect upon the size of the fruit., there being 63 per cent. more of the desirable sizes than on the plots not green-manured. The trees where legume green manure had been used were in much better health, as evidenced by the fact that only 3 per cent. of the leaves were 'mottled' during the seasons of 1912, 1913 and 1914, while on plots similarly fertilized, where legumes had not been used, the average was 13·5 per cent.

Green manures have additional values in that their growth prevents serious washing of the soil during heavy rains.

Large amounts of nitrogen are saved from leaching below the limits of roots by growing winter-green manure crops which utilize the excess nitrogen, and hold it until they are ploughed under. The decay of the roots of the crop tends to make the soil more open to the access of air and water.

Green-manure crops may be expected to give most satisfactory results when ploughed under to a depth of from 7 to 10 inches. They should never be ploughed under when the land is dry, as this will result in poor incorporation of the green tops, and slow decay.

Devil's Grass.

There is an old proverb, 'give the devil his due', which may also reasonably apply to devil's grass (*Cynodon dactylon*), known in the Southern States of America as Bermuda grass. West Indian planters know well that this grass is a pestilent weed among crops, almost impossible of eradication once it has taken hold of a field, and that it can only be kept under control by careful cultivation. Still it is always interesting to hear another side of any question, and a veritable *advocatus diaboli* in this matter is Mr. Samuel M. Tracey, whose interesting paper, 'Bermuda Grass', is published by the United States Department of Agriculture as *Farmers' Bulletin*, 814.

Mr. Tracey considers that as a permanent perennial meadow grass, Bermuda grass is the most valuable in the south-eastern part of the United States, where it has been grown for more than a hundred years.

There are several distinct varieties, differing in vigour of growth and in the character of the underground running stems or stolons. The best variety for a hay crop is said to be the Giant Bermuda grass (*Cynodon dactylon*, var. *maritimus*), which was introduced into the United States from Brazil a few years ago. This variety, on a rich moist soil often makes 'runners' 20 feet or more in length, with an abundance of erect stems 2 feet or more in height, affording two or three annual cuttings, and yielding more than any other variety yet tested by the United States Department of Agriculture. It is true that the yield of hay varies greatly with the locality where the grass is grown. On favourable soils it has been known to yield annually from 6 to 8 tons per acre.

As a pasture grass on lands of ordinary fertility in the South-eastern States it is calculated to support one steer per acre for eight to nine months.

In spite of these data, it would hardly be wise to import into these islands the giant variety—the dwarf devils we know are probably better than this unknown giant—or rather not quite so bad from our point of view.

One value of Bermuda grass mentioned by Mr. Tracey is quite comprehensible from the nature of its growth. It has been found of great use in stopping the wash of gullies, and in binding the slopes of embankments.

The Position of University and Higher Technical Education.

In *Nature*, August 15, 1918, there appeared a very striking article on this subject from the pen of Professor R. A. Gregory, a well-known authority on such subjects. The article is a review so to speak of the report, issued early this year, of the Government Committee under the championship of Sir J. J. Thompson, on the position of natural science in the educational system of Great Britain.

Professor Gregory points out the very inadquate assistance afforded by the Government of the United Kingdom to higher technichal education, when compared with what is done by the Government of the United States, and of Germany. He concludes that it is evident that in the domain of higher education the United Kingdom compares very unfavourably with those two powers. Yet the conditions of industrial development, and, we may add, of agricultural development also, and the competition in both fields of other nations, make it essential to secure an adequate supply of trained workers.

Increased grants to universities and technical institutions are needed to enable the tuition fees to be reduced, and so to attract a large number of men to such institutions who are now unable to stand the expense of the course of training. Increased grants are also needed to enable the tuition fees to be reduced, and to ensure that the staffs are paid salaries commensurate with the high qualifications demanded of the members of such staffs. The present aid given by Parliament is in no way adequate to modern needs, and compares very unfavourably with what is available in the United States and in Germany. The grand total of all Parliamentary grants to universities and technical colleges in the United Kingdom is about £500,000, whereas the Federal and States grants in the United States amount to £7,000,000, and in Germany to nearly £2,000,000. The provision made by Parliament for higher education is thus obviously not that which should be expected of a State which intends to maintain its position among leading Powers, more especially in the arts of peace.

INSECT NOTES.

WEEVILS ATTACKING SWEET POTATO AND YAM.

Two papers dealing with weevils of the groups to which the Scarabee and sweet potato weevil belong have recently been issued. One of them, by Dr. G. A K. Marshall, appeared in the *Bulletin of Entomological Research*, London, Vol. VIII, February 1918, p. 269, entitled 'A New Weevil Pest of Sweet Potatoes in Jamaica'. The other, by Dr. W. D. Pierce, published in the *Journal of Agricultural Research*, Washington, Vol. XII, No. 9, March 4. 1918, was entitled 'Weevils which affect Irish Potato, Sweet Potato, and Yam'. Dr. Marshall describes *Palaeopus costicollis*, a new species sent in by Mr. A. H. Ritchie, Government Entomologist, Jamaica, who found this insect doing serious damage to sweet potato. In general appearance it is so much like the Scarabee (*Euscepes batatae*) that it might be mistaken for that insect; the injury to the sweet potato is similar to that of Scarabee also. It is considered likely that the two insects have been confused under one name, and that the injuries resulting form the attacks of both have been up to the present time attributed entirely to the Scarabee.

Two other specimens of weevils of this genus in the collections in the British Museum, very similar in appearance to *P. costicollis*, proved to represent two new species, and while nothing is known of their habits, it is suggested that these will be similar also.

These two species are *P. grenadensis* from Grenada, and *P subgranulatus* from St. Vincent.

Dr. Pierce, in this paper describes a new species of this genus from Jamaica as a pest of yams. The name given to this is *Palaeopus dioscoreae*. It was described from two specimens reared from tubers of yam (*Dioscorea batatas*) by Mr. S. F. Ashby. in 1914.

This indicates that the genus Palaeopus attacks yams as well as sweet potatoes, and the new species described from Grenada and St. Vincent may prove to be pests of yams, or even of other starchy roots or tubers.

Dr. Pierce also deals with the sweet potato weevil (*Cylas formicarius*, Fabricius) and other species of the genus. It would appear that there has been some confusion in the identity of certain species of this genus. Three species known or supposed to be pests of sweet potato seem to be well established. They are *Cylas formicarius*, Fab., *C. turcipennis*, Boheman, and *C. femoralis*, Faust.

An account of *C. formicarius* was given in the *Agricultural News*, Vol. XVII, p. 42. This insect has greatly increased in importance in the United States and the West Indies within the past few years. *C. turcipennis* occurs in India, the Dutch East Indies, and the Philippine Islands, while *C. femoralis* is recorded from Liberia and Kamerun, Africa.

DISTRIBUTION OF WEEVILS ATTACKING SWEET POTATO AND YAM.

Jacobs or Scarabee (*Euscepes batatae*, Waterhouse). General throughout the West Indies. Occurs in Brazil, the Hawaiian Islands, Guam, and New Zealand.

Palaeopus costicolis, Marshall. Occurs in Jamaica, similar in appearance to the Scarabee, and affects sweet potatoes in the same manner.

Sweet potato weevil (*Cylas formicarius*, Fabricius) General throughout the Eastern Tropics. Occurs in the Southern United States, Porto Rico, the Bahamas, and British Guiana.

Cylas femoralis, Faust. A serious sweet potato pest in Liberia. Occurs in Kamerun.

Cylas turcipennis, Boheman. Occurs in Java Sumatra, the Philippine Islands, Sarawak, and India. The food of *C. turcipennis* is not recorded.

Palaeopus dioscoreae, Pierce. Occurs in Jamaica; attacks the tubers of yams.

Palaeopus grenadensis, Marshall. Described from a museum specimen from Grenada.

Palaeopus subgranulatus, Marshall. Described from a museum specimen from St. Vincent. Feeding habits of the two species last mentioned are not known; they may attack sweet potatoes or yams.

TERMITE INJURY TO SWEET POTATOES.

A note on the above subject by E. W. Berger appeared in the *Quarterly Bulletin* of the State Plant Board of Florida, July 1918, which appears of interest to planters in the West Indies, and is reproduced below.

Owing to the great importance of sweet potato weevil (*Cylas formicarius*, Fab.) sweet potato growers should be on the watch for it everywhere, and especially in sections supposed to be free from the pest.

Among injuries most likely to be confused with the work of the sweet potato weevil are those caused by termites or 'white ants' The differences between the injuries done to the tubers by the two pests are summarized as follows:—

1. 'Absence of larvae (grubs) and pupae in the tunnels when infested by termites, but their presence in apparent abundance when the tuber is infested with the weevil.

2. 'Absence of frass (excreta) when the injury is due to termites, but an abundance of this in the tunnels produced by the weevil.

3. 'Exit and entrance holes very apparent with termites, but tuber infested with weevil may show little or no outward evidence of its condition inside.

4. 'The clean-cut outlines of the tunnels made by the termites are in marked contrast with those made by the weevil.

5. 'If the plants are growing, tunnelling larvae (grubs) in the stems near the ground indicate the weevil.

6. 'The presence of large (about $\frac{1}{4}$-inch long) ant-like insects with black head and snout, brick-red thorax (middle) and legs, and dark steel-blue end, is an almost certain sign of the weevil.

7. 'The presence of whitish, rapidly running insects, having much the appearance of ants, indicates termites.'

H.A.B.

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., the Imperial Commissioner of Agriculture, has returned to Barbados after paying an official visit to St. Vincent.

Mr. W. Nowell, D.I.C., Mycologist on the Staff of the Imperial Department of Agriculture, has also returned to Barbados after a visit to Grenada for the purpose of investigating a disease of coco-nut trees in that island.

THE TIMBER INDUSTRY OF BRITISH GUIANA.

A pamphlet, prepared by the Honorary Secretary of the Permanent Exhibitions Committee of British Guiana, and recently issued by that Committee, contains much useful and interesting information with regard to the forest industries of that colony.

The forests of British Guiana cover some 78,000 sq. miles of country, or about six-sevenths of the whole area of the colony. The utilization however of the practically illimitable forest resources of the colony is checked by great difficulties of transportation. Although British Guiana possesses considerable facilities in waterways, much of the most valuable timber, having a higher specific gravity than water, cannot be transported over such obstacles as cataracts and rapids.

The trees composing the forests of British Guiana are rarely of social habit. Many different kinds of trees exist in any one area, and the forests are of the class termed 'mixed'. The forests vary in height. On the low coastlands and along the tidal reaches of the rivers the average height of the trees would be about 60 to 70 feet, but further inland they are, on the average, about 100 feet in height. As a rule, the trees in the high forests rise with straight, clean stems, and are of small girth proportionately.

The following industries are carried on at present in connexion with the forests of the colony: Wood cutting for (a) timber and lumber, (b) wallaba shingles, paling and vat staves, and posts, (c) charcoal, (d) firewood.

Greenheart (*Nectrandra Rodioei*) is commercially the best known of all the timbers of the colony. Large quantities have been regularly exported for many years. On account of its resistance to the action of water and boring molluscs, it is chiefly used for submerged work such as wharves, piles, dock and lock gates. There are two varieties of this wood, the brown or yellow greenheart, and the black variety which is much scarcer. Logs of greenheart can be obtained from 10 to 25 inches square, and up to 65 feet in length.

In habit the greenheart is partly gregarious. The greenheart areas are estimated to contain an average of thirty-two trees to the acre, and are almost entirely confined to the central parts of the colony. There is a large quantity of this wood in the interior waiting easier means of transport for exploitation.

Another wood which is exported in considerable quatities is the crabwood (*Carapa guianensis*), of which there are also two varieties, the red and the white. The former is a red-coloured wood, with a moderately coarse and open grain, and is locally the most popular furniture wood. It resembles mahogany in appearance when polished. The white is similar in structure to the red variety, but paler in colour. Logs of crabwood can be obtained ftom 40 to 60 feet long, and from 10 to 16 inches square.

The most abundant of the colony's timbers are the several varieties of wallaba. Those principally used are 'soft wallaba' (*Eperua falcata*), and Ituri wallaba (*Eperua Jenmani*). The heartwood of these varieties is in great demand for posts, and for making shingles, etc. Wallaba is a heavy hardwood, with a very coarse, but more or less even grain. It splits readily, and is very resinous. It has been favourably reported on as a material for wood-block paving.

In addition to the abovementioned woods there are many other valuable timbers of which at times some are exported in small quantities. Of these we may mention the wood of the locust tree (*Hymenaea Courbaril*), and the bullet tree (*Mimusops globosa*), which latter, however, is only now cut by permission for special purposes, that tree being the source of balata.

There is a considerable charcoal-burning industry on the Demerara and Berbice Rivers. All kinds of wood and all parts of the trees are used for the purpose, and are converted into charcoal by being burnt in covered pits dug in the sand. The charcoal is largely exported to the southern West Indian islands.

On the river lands all kinds of wood are cut for fuel, but wallaba is mostly favoured, as it splits readily and burns well. Practically all the firewood exported is from the lower Demerara River, whence it can be transported cheaply for shipping to Barbados and other West Indian islands.

In normal years the colony of British Guiana exports about 280,000 cubic feet of timber, 250,000 feet of lumber, 2,500,000 wallaba shingles, 4,000 tons of charcoal, and 9,000 tons of firewood.

Besides these timber exports there are—apart from the considerable collection of balata, which amounted in 1917 to 1,595, 888lb. of the value of £198,871—exports of certain gums, oils, resins, etc. Gum animi, the product of the locust tree is exported in small quantities. This gum in its fossil state resembles amber in appearance, and is often found in blocks of considerable size. Hiawa gum, or 'resin of conima', used for incense, is obtained from *Protium heptaphyllum*, a common tree in the colony.

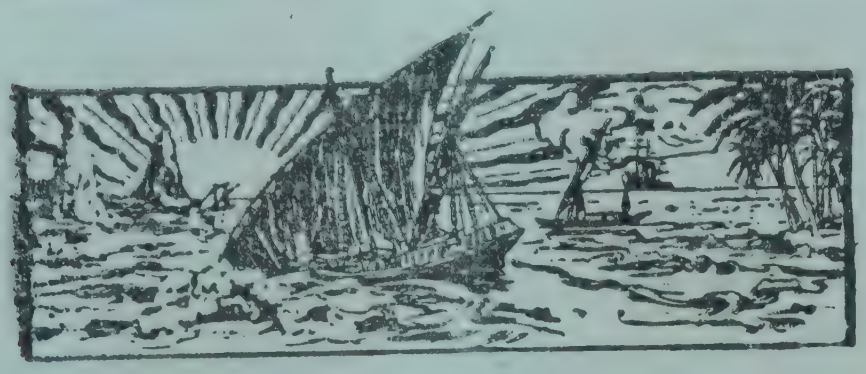
Among other forest products which are collected and exported are Tonkin beans, which are borne on the Kumara or Tonkia bean tree (*Dipteryx odorata*)—a large tree growing plentifully in the region above the rapids of the Essequebo River—and Souari or butter nuts, the product of *Caryocar tomentosum*. This is one of the giants of the forest. Under cultivation at Onderneeming Experiment Station, trees of this species have fruited in six years from planting.

It is very evident from the foregoing, that the forests of British Guiana possess vast potentialities, only limited by lack of transport facilities, labour, and capital.

HYGIENE IN THE PRIMARY SCHOOLS OF ST. LUCIA.

In his annual report on the Education Department of St. Lucia, Mr. T. H. K. Moulder, the Inspector of Schools of the colony, states that hygiene is taught regularly throughout all the juvenile schools of the colony. Although many of the children are unfamiliar with the terms 'malaria' and 'hookworm,' the majority of them do know that mosquitoes produce fever, and that neglect to wash hands and feet when they are muddy may give them hookworm Mr. Moulder is satisfied with the progress which is being made in the knowledge of this subject in the upper standards of the primary schools.

He says that the following summary of statements in the reports sent to him by the head teachers, is interesting to note: 'The applications for quinine, both by children and parents, are beginning to show that they are convinced of its effectiveness as a specific for malaria; despite the taste, the children now take quinine more easily, in the hope of being cured. Children do not indulge in playing in the earth as they used to do, and come to school with their hair properly combed, and their faces, hands, and feet well washed. Theory and practice are getting more closely associated, especially when it is seen that the habits of cleanliness mean the avoidance of disease.'



GLEANINGS.

Iceland, too far north to raise wheat, is preparing to make herself independent of grain ships by converting part of her potato crop into flour. (The *Southern Planter*, August 1918.)

Experiments have been made in Jutland in the utilization of grass for the manufacture of sewing thread. The experiments are said to have given very promising results. It is also reported that an inventor in Sweden has succeeded in producing from fir an artificial silk of excellent quality, soft, glossy, and strong. (*The Board of Trade Journal*, August 15, 1918.)

The United States Consul at Rosario, Argentina, reports, according to the *Louisiana Planter*, August 24, 1918, that there is the promise now of more than double the crop of sugar in the State of Tucuman, as compared with that of 1917. The estimated crop for this season is about 200,000 metric tons, as against the complete yield for 1917 of 88,075 tons.

The *Cuba Review*, August 1918, states that Spain is again permitting the exportation of olive oil, and considerable quantities are now being imported into Cuba, the price however being several times more than normal. Cargoes of rice also continue to come direct from the Orient to Cuba by sailing vessels, and also considerable quantities of American rice are brought over through the Gulf.

According to the *Journal of the Board of Agriculture*, July 1918, investigation was made in France last year on the use as fodder of the seaweed common on the Berton coast. Experiments showed that as a feeding stuff 3 lb. of the dried seaweed material were equivalent to 4 lb. of oats. Horses suffering from lymphangitis improved under this diet and the disease disappeared. This action has been attributed to the trace of iodine present in the material, but the statement needs further evidence.

Profitable utilization of the husk of the cacao bean which is detached, and not included in the manufacture of high grade cacao, has occupied the attention of numerous chemists and agriculturists. Among the uses to which the husks have been put is their employment in cattle foods. Feeding experiments have shown that cacao shells are fattening fodder for cattle, and that the daily yield of milk from cows is considerably increased as the result of the use of this material. (The *Analyst*, June 1918.)

The Board of Trade Journal, August 15, 1918, states that the Board are in receipt of information, through the Foreign Office, from His Majesty's High Commissoner in Egypt, that the area sown with the various descriptions of cotton in Egypt in the present season is 1,315,572 feddans. Of this total, 952,480 feddans are under the Sakellarides variety, chiefly grown in Lower Egypt, and 273,936 feddans under Ashmûni, which is almost all grown in Upper Egpyt. (A feddan is practically the same as an acre in square measurement).

In rose pruning, the rule is that strong-growing plants require lest severe pruning than weak-growing ones. As roses always flower on new wood, it is essential that the bushes be pruned regularly, if good blooms are desired. All weak growths, exhausted and worn out wood, must be removed, retaining only vigorous growths. It is generally advisable to prune to four or five eyes or buds, so as to have subsequent strong growth. Spindly growth, especially in the centres of the bushes, should be removed. (The *Journal of the Department of Agriculture*, Victoria, Australia, June 1918.)

The grand total of allotments in England and Wales at present covers an area of about 200,000 acres, says the *Journal of the Board of Agriculture*, July 1918. Taking this figure and estimating that 50 per cent. of each allotment is planted with potatoes—a conservative estimate—we have 100,000 acres of potatoes on our allotments. If these produce an average of 7 tons per acre (a moderate assumption for garden and allotment potato crops) this means that the allotment holders of England and Wales will grow this year 700,000 tons of this most essential war-time crop practically on the spot where it is to be consumed.

Since September 1, 1917, approximately 200,000,000lb. of sugar have been used by the United States Army, and this amount is exclusive of depots and camps on the western coast which have been using raw sugar from Manila, having it refined in the West. A conservative statement of the amount of sugar procured on the Pacific coast is about 25,000,000lb., making the total purchase for the Army 225,000,000lb. By calculation it is found that about 237 lb. of sugar are consumed per thousand men at their meals in one day—a little under 4 oz. per soldier per day. (The *Louisiana Planter*, August, 31, 1918.)

Amongst suggestions for the preparation of locally grown foodstuffs in a circular issued by the Acting Director of Agriculture, Trinidad, the following is worth drawing attention to: 'To prepare corn to get best results for several kinds of bread or pudding it is best to take off the skin. This is done as follows: To 2 lb. corn allow 2 lb. sifted ashes and about 1 gallon water, and boil for one hour. It is sufficiently boiled when a grain squeezed between the fingers pulps out of the shin. Place the pot from the fire under a stream of cold water, and rub the corn with the hands, when the skin will easily separate, and the overflow of water will carry away all the ashes and the skin. When clean, drain off the water, add about 1½ gallons clean water, and reboil for about fifteen minutes The grains must then be crushed into a fine paste, either in a mill or a meat mincer.

MINOR CROPS ON COCO-NUT PLANTATIONS.

An interesting story of the establishment of a coco-nut plantation in Porto Rico, written by Arthur J. Harvey, appears in the *Revista de Agricultura de Puerto Rico*, April-May 1918, from which some of the beginners in coco-nut planting in these smaller islands may get hints.

Mr. Harvey and his brother purchased, at the beginning of 1913, 530 acres of land in the neighbourhood of San Juan, with the object of establishing a coco-nut plantation. The property, as a whole, is flat, rising only a few feet above the level of the sea. The soil is a sandy loam.

A part of the estate had been under pine-apple cultivation for three years previously, but the greater part of the land remained in pasture, or was covered by bush There were only six coco-nut palms in bearing on the property.

After having performed some necessary clearing the brothers began to set in their coco nut palms at a distance of 33 feet apart each way. This gave forty trees to the acre. Although this space between palm and palm seems considerable when they are young, yet by the time the palms, if healthy, are between four and five years old, the leaves touch one another. The planting of coco-nuts in seed-beds is advised, rather than planting them *in situ*. Mr. Harvey accentuates the importance of chosing the nuts for planting not only with reference to their size, but looking to their origin from healthy and productive parent trees. Very soon it was determined that it would be unadvisable to pasture animals on the plantation. In the first place, because of the damage which cattle do to small palms; and secondly, because of the necessity of keeping the ground in cultivation.

Stable manure has been the principal fertillizer used on the property. In opening the holes for the young plants they were made 3 feet in diameter by a foot and a half in depth, and a bag of dung was placed in each hole. The urine of the cattle was carefully preserved in a concrete cistern, and the application of it to the palms was very beneficial. The method of applying it was by transporting it to the field in barrels and immediately after having poured it round the trunk, covering it with earth, to avoid as far as possible loss of ammonia. Good results also have been obtained by using seaweed and other marine plants heaped around the trees.

It was desirable to maintain under cultivation the largest possible area of land between the coco-nut trees, and in order partly to recover the expense which this could not but occasion, potatoes, maize, beans, etc., were grown.

The planting of potatoes has been the most extensive, occupying at present some 40 acres. The produce of this crop has met with ready sale at a price from 2 to 3c. per lb., as varieties were chosen which were of local reputation.

The crop of potatoes reaped during 1917 reached a total of about 42,000 lb. from 20 acres planted, that is to say, an average of 21,000 lb. per acre. During this period the local market price per lb. was 2½c. on an average, giving a gross return of $52·50 per acre. No kind of fertilizer was used on this crop. The ground however was prepared as usual by ploughing and forking, and the slips planted in trenches. Besides the potato crop, yams and tanias have been planted to a lesser extent. Certain varieties of tanias gave excellent results on the flat land.

In addition a respectable quantity of maize has been reaped. The greatest obstacle to the cultivation of the maize on the sandy soil was the damage occasioned by the changa or mole cricket, which in many cases prevented the plants from growing uniformly.

At the present time a great extension has been made in the cultivation of beans of various kinds. In one variety of these not less than 25 acres have been cultivated. Great benefit has accrued, as might be expected, from alternating the cultivation of potatoes with that of legumes.

Actually, of about 300 acres planted in young coco-nuts, most of it could be maintained under minor crops, especially by the cultivation of roots such as yams and potatoes. In same cases, where it has not been possible to place under cultivation the whole extent of ground between the coco-nut palms, it has been found most desirable to plant sword beans, because not only are they of value as a fertilizer, but because of the protection which their foliage gives to the superficial roots of the young palms.

The primary aim of Mr. Harvey and his brother was to plant coco-nuts on their estate, and to induce them to produce fruit as soon as possible. The production therefore of minor crops was only of secondary importance. The experience acquired by this procedure has proved to their satisfaction that the practice of more or less intensive cultivation on a coco-nut plantation far from occasioning prejudicial results to the growth of the coco-nut palms, has been of benefit. On the sections of the estate thus cultivated the palms have grown twice as tall as those on other sections where the land around them has not been cultivated.

Recipes for the Preparation of Coco-nut Press-Cake for Human Food.—The possibilities of the press cake obtained from copra after the expression of the oil are worthy of consideration not only as a stock food, but for human consumption as well. Recipes for the preparation of food products from the coco-nut meal obtained from this process are given as follows:—

Coco-nut oven scones: ½-cup coco-nut meal, ½-cup flour, 1 teaspoonful baking powder, ¼-cup sugar, ½-cup eggs, milk sufficient to make batter, ¼-teaspoonful salt—cook thirty minutes in a hot oven. *Coco-nut gems:* ½-cup coco-nut meal, ⅔-cup flour, 1½ teaspoonful baking powder, ⅕ cup sugar, milk sufficient to make batter, ½-teaspoonful salt—cook for thirty minutes in a hot oven. *Coco-nut griddle cakes:* ½-cup coco-nut meal, ½-cup flour, 1 teaspoonful baking powder, 1 cup eggs, milk sufficient to make batter, ½-teaspoonful salt—cook until brown, fried in lard or crisco. *Coco-nut rusks:* ¼-cup coco-nut meal, ½-cup flour, 1 teaspoonful baking powder, ⅙-cup sugar, 1 cup eggs, ¾-cup milk, ½-teaspoonful salt—cook from thirty to forty minutes in hot oven. A ½-teaspoonful each of nutmeg and cinnamon is added to the dough, and the surface is sprinkled with sugar and cinnamon. *Coco-nut bread:* ¾-cup coco-nut meal, ¼-cup flour, 5 teaspoonfuls baking powder, ¼-cup sugar, 1 cup eggs, 1 cup milk, ¾-teaspoonful salt—cook thirty to forty minutes in a hot oven.

It will be noticed that in all of these products no lard, crisco, or butter is needed for shortening. Water may be substituted in all cases for sweet milk.

In view of laboratory tests, it seems possible that coco-nut meal might be substituted to advantage for wheat flour and lard in the preparation of cheap edible products. It must, however, be borne in mind, that the meal used was obtained from freshly dried coco-nut meat and not from ordinary commercial copra meal; meal from fresh machine-dried copra would be valuable for the same purpose. It would seem that there is a good opportunity for a plant producing edible oil and press-cake for human consumption.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. The following comprised plant distribution during the month of September: coco-nuts, 50; budded oranges, 6; grafted mangoes, 6; timber trees, 12; oranmental plants, 16; cuttings, 36; castor oil seeds, 5¼ lb.; palm seeds, 12,200. Regarding staple crops, Mr. J. C. Moore, the Superintendent of Agriculture, states that the cacao crop will be very late, but of fair promise; the lime crop in Carriacou is reported good and a few fields of Sea Island cotton sown in June-July in Grenada are reported as showing good promise Thrips appears to be normal in distribution and intensity of attack: spraying with Bordeaux-Nicotine is in progress on several estates. The rainfall recorded at Richmond Hill for the month was 9·80 inches.

ST. VINCENT. According to notes forwarded by Mr. W. N. Sands, Agricultural Superintendent, during the month of September in most districts the weather was favourable, and the crops made good progress. Cotton picking was commenced on several estates, and the corn crops were being reaped. Corn was being bought by the Granary, and also for shipment to the United Kingdom. The collection and destruction of cotton stainers and bush bugs found in the early planted cotton fields was being continued. The weather was seasonable—plenty of rain and sunshine. The rainfall recorded at the Botanic Station was 15·48 inches; at the Experiment Station, 16·81 inches.

Special work of officers of the local Agricultural Department during the month included visits to certain estates in connexion with the collection and destruction of cotton stainers and bush bugs. Returns of the acreage of cotton planted in the colony, sent in to the Cotton Inspector, indicate an area exceeding 4,000 acres.

ST. LUCIA. Plant distribution during the month of September comprised—limes, 2,250; budded oranges, 12; grafted mangoes, 6; ornamental plants, 2; and in addition, 70 packets of vegetable seeds, and 5,500 cassava cuttings. Regarding staple crops, Mr. Brooks states that the reaping of cacao was now in full swing, the lime crop was slackening; and there was a good stand of sugar canes. Three crates containing commercial samples of sugar, cacao, copra, lime juice, and lime oil, obtained from the Cul-de Sac Company, were forwarded to the Commercial Museum at Ottawa. The opening of this Museum by the Canadian Department of Trade and Commerce in which a West Indian section has been instituted, and the benefits likely to accrue therefrom, were referred to editorially in a recent number of the *Agricultural News* (Vol. XVII, No. 427, p. 273). The rainfall recorded at the Botanic Gardens, Castries, during the month, was 6·40 inches; at the Agricultural and Botanic Station, Choiseul, the total precipitation was 9·18 inches.

DOMINICA. The Curator, Mr. Joseph Jones, states that the quantity of limes reaped from the Lime Experiment Station during the month of September was 80 barrels, making a total of 617 barrels since April 1. when harvesting was commenced. Plant distribution included—limes, 1,145; grafted mangoes, 9; miscellaneous plants, 44. In addition the following were sold: vegetable seeds, 165 packets; black-eye peas, 95 lb.; horse beans, 20 lb. The local price for limes and raw lime juice remained unchanged. Planters are said to be in general agreement that the crop this year is a short one. That lime products are being disposed of satisfactorily is evidenced by the shipment during recent weeks of 21,000 gallons of concentrated juice, and 162,000 gallons of raw juice. A visit by the Mycologist on the Staff of the Imperial Department of Agriculture to the Gardens and Experiment Station on September 10 and 11, while on his way from Barbados to Montserrat, is recorded. The total rainfall recorded for the month was 4·14 inches: there were twenty-five dry days during ths month.

MONTSERRAT. The weather during the month was very seasonable, and gave the heaviest rainfall since September last year, Mr. Robson writes to say. As a result, the outlook for provision crops, including ground nuts, has improved considerably. Plant distribution during the month included—bay plants, 1,300; papaw plants, 86; galba, 36; sword and Stizoblium beans, 50 lb.; cowpeas, 6 lb., pigeon peas, 4 lb. The bay experiment plot is making profuse growth, the acre having yielded so far, 5,500 lb. for 1918. Matters have improved considerably in connexion with the cotton crop, and the prospects of good second pickings are better than for some years. Leaf-blister mite, however, is more prevalent than for many years, and is sufficiently severe in cases to retard the development of the second growth. On the whole, it is questionable if the crop can come up to the average of previous years, though growers feel satisfied with the results so far. The lime crop reaped has been small, but a second crop is looked for later in the season. The position as regards sugar-cane seems to be retrograde; the area in plant canes is less than for some years. Except in one or two localities, cotton stainers have not increased to the extent expected; persistent collecting of the insect has been carried out. The Mycologist of the Imperial Department of Agriculture, Mr. W. Nowell, visited the island from September 12 to 14, and was concerned with the investigation of cotton diseases. Consideration is being given to the destruction of the silk-cotton and mahoe trees in the island, and it is expected that operations in this direction will commence at an early date. The chief matter of interest to the island at the present time, Mr. Robson states, is the anticipated return from the cotton crop, the present area under cotton being the largest in the history of the industry. The rainfall recorded for the month at Grove Station was 7·83 inches, and was well distributed The total rainfall for the year to date is 37·94 inches.

ANTIGUA. During the month of September the following plants were distributed from the Botanic Gardens: sisal, 6,300; eucalyptus, 984; mahogany, 282; lime plants, 150; Guinea corn seed, 65 lb.; Indian corn, 390 lb.; cotton seed, 661 lb.; vegetable seeds, 3 packets; sweet potato cuttings, 120; cassava cuttings, 24. Mr. Jackson states that good rains fell throughout the island during the early part of the month, in consequence of which the cane crop has materially improved. Good returns from this crop cannot, however, be expected this year, he adds, unless exceptionally favourable weather is experienced from now until the end of the rainy season. The cotton crop, on the whole, looks fairly well, and reaping from the early fields has been commenced. The rainfall registered at the Botanic Station for the month was 5·23 inches; for the year, 27·03 inches.

Appended to the foregoing is a short report on agricultural instruction for the months of August and September. In this, reference is made to the dry weather experienced, and the condition of the cotton and corn crops in consequenee thereof. The reaping of the corn crop was completed during these months, the corn being disposed of locally at rates varying between 7*s.* to 10*s.* per 100 lb. on the cob. There is about 5,000 lb. remaining unsold.

ST. KITTS. Mr. W. R. Shepherd, Superintendent of Agriculture, writes to say that fine rains during the month of

of September have considerably improved the appearance of the Gardens. A large number of Cypre seeds (*Cordia gerascanthus*) have been received from Trinidad, and plants will soon be ready for transplanting, and for distribution. The old cane crop has responded to the rains of the past month, and the plant canes have much recovered. The ratoons, especially in the Valley district, were so badly affected by the long drought, that only a moderate return is expected from them. Prospects for the next crop have somewhat improved however, but, Mr. Shepherd states, all depends on constant rain for even an average return. Picking of cotton is in full swing and the returns from all districts are distinctly good. The quality of the lint is also good and uniform. Of the new crop 95 bales have been purchased by the Government at an advance price of 3*s.* per lb. The rainfall for the month was 6·22 inches; for the year to date, 29·30 inches.

NEVIS. According to the notes forwarded by Mr. W. I. Howell, Agricultural Instructor, the crops on the whole are doing much better in consequence of the good rains which fell during September. From the Botanic Station, 13,000 sweet potato cuttings were distributed. The cane crop throughout the island has very much improved. Preparation for next season's crop is in progress. The cotton crop is very much more promising and a fair yield is expected; picking from the early fields is in full progress and good returns have been obtained from some of these. Cotton stainers are very plentiful and the percentage of stained cotton is high. Over 900 acres are planted in provision crops, chiefly sweet potatoes, cassava, and yams. The potato crop will be a large one—perhaps more than can be consumed locally. The rainfall for the month was 6·21 inches; for the year to date, 34·36 inches.

AGRICULTURE IN GRENADA.

The progress report on the work of the Agricultural Department for the quarter ended June 30, 1918, a copy of which has been forwarded to this Office, contains matters of interest noted below.

In the Botanic Gardens, the routine work connected with the upkeep of the economic and ornamental sections of the grounds has been maintained. Considerable interest has been aroused in the efforts to establish an onion industry. The small crop of onions obtained from the plot in the Gardens were retailed in single strings, with the object of spreading as widely as possible a knowledge of the quality of the local product. Several imported varieties of manioc have been placed under trial, and the area under tannias extended Sowings of several varieties of edible beans have been made for trial purposes and seed production. Sea Island cotton seed amounting to 800 lb. was imported from St. Vincent by the Department for local distribution, and about 450 lb. disposed of at cost price. The list of plants and seeds distributed during the quarter, appearing in the report, indicate the large amount of work in this direction that was successfully accomplished during the period under review.

Regarding minor industries, there are ample indications that the area put under ground provisions and corn this year will exceed that of any previous year. Owners of estates have considerably assisted in these efforts by the rental of land for garden purposes at a nominal value, and by themselves taking up provision growing. The Government also have assisted in a similar manner. It is further worthy of note that increasing attention is being given to yam cultivation.

AGRICULTURE IN BARBADOS.

The weather for October has been most favourable. Heavy and continuous rains fell during the first week, but since that time there have been in general only light rains.

The fair days of the past fortnight have greatly aided the planters in making progress with tillage of various kinds. A considerable amount of forking and ploughing has been done.

Sheep manure is being extensively used. It would appear that planters are giving a more liberal application of farmyard manure and making up the deficit with sheep manure. In addition to this, we understand that several planters are substituting sheep manure this year for early cane manure.

With the approach of the planting season, planters are discussing the proportion in which they should plant the different seedlings. It would appear that the B.H. 10 (12) is going to receive a very appreciable increase ef patronage. This seedling has given proof of excellent qualities, and the decision to increase its area is to be expected.

The B. 6450 is a tried seedling and it would be well if it were given a fair share of patronage. Its poor germination, with the consequent laborious supplying before it is established, has caused planters, especially in the drier districts of the island, to look with greater favour on the B.H. 10 (12) and the Ba. 6032.

We recommend that small areas of the B.3922 and the B.6308 be planted, the former in the red soil, as it is an excellent ratooner, and the letter in the black soil. The B.6308 will give a good account of itself as a plant cane.

With the increase in the number of fields of potatoes which are being placed on the market, the supply has grown more plentiful.

The Indian corn crop is being rapidly disposed of and is growing somewhat scarce.

The major part of the cotton crop, such as it is, is to be found in the leeward parishes. It is reported to be looking well, and picking has been started.

The fields under yams present generally an excellent appearance and promise well. We have also observed some good fields of white eddoes, but the nut eddo is conspicuous by its absence in many districts, and by its feeble growth in most. (The Barbados *Agricultural Reporter*, October 19, 1918.)

Power Alcohol.—The *Experiment Station Record*, June 1918, contains a note in reference to proposals for the production and utilization of power alcohol in Australia, which are discussed in the *Bulletin of Science and Industries*, 6 (1918), of the Australian Advisory Council. This publication includes a general discussion of the question of liquid fuels in Australia, the advantages of alcohol as a fuel, and the available sources for its production, with the relative cost of the product from each source.

The crops suggested as promising for cultivation as raw material for the manufacture of power alcohol are green sorghum stalks, sorghum grain, cassava, and sweet potatoes. As these crops are not grown at all, or only on a small scale in Australia at the present time, it is suggested that their development may lead to the cultivation of areas suited for other crops, and so may assist in diversification. It is recommended that power alcohol be denatured with 2 per cent. of either the fractions of coal-tar oil distillates, obtained at a temperature of from 170° to 230°C., or with creosote oil.

MARKET REPORTS.

London.—The West India Committee Circular, August 22.

Arrowroot—No quotations.
Balata—Venezuelan Block, no quotations; Sheet, no quotations.
Beeswax—No quotations.
Cacao—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 4/6 to 5/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—9½*d*.
Rubber—Para, fine hard, 3/0½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., October 4.

Cacao—Venezuelan, no quotations; Trinidad, no quotations.
Coco-nut Oil—$1·46 per gallon.
Coffee—Venezuelan, 15c. per lb..
Copra—$7·25 per 100 lb.
Dhal—$11·50 to $12·00 per bag.
Onions—$10·00 per 100 lb.
Peas, Split—$8·00 per bag.
Potatoes—English, $4·00 per 100 lb.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros. & Co., October 2

Cacao—Caracas, 13½c. to 14c.; Grenada, 13¾c.; Trinidad, 13¾c. to 14c.; Jamaica, 12c. to 12½c.
Coco-nuts—Jamaica selects, $50·00; Trinidad $52·00; culls, $27·00 to $29·00 per M.
Coffee—Jamaica, 10½c. to 10¾c. per lb.
Ginger—17c. to 22c. per lb.
Goat Skins—Importation prohibited.
Grape Fruit—Jamaica, $4·50 to $5·50.
Limes—Importation prohibited.
Mace—40c. to 45c. per lb.
Nutmegs—31c. to 32c.,—unassorted.
Oranges—$4·50.
Pimento—9¾c. to 10c. per lb.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·055c. Molasses, 89°, 4·998c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., October 18.

Arrowroot—$12·00 per 100 lb.
Cacao—$12·00 to $12·50 per 100 lb.
Coco-nuts—$30·00 husked nuts.
Hay—$3·00.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $5·50.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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A Preventible Loss of Man-power.

ONE of the results of the war will certainly be a diminution in the number of men available for agricultural labour throughout the world. The hundreds of thousands of young, strong men actually killed, together with the still greater number maimed and partially, if not entirely, incapacitated for hard work, must inevitably lead to a shortage in man-power. And this is the more serious as it is necessary to increase the available food supply of the world, and to restore to fertility the great extent of hitherto cultivated lands now wasted and devastated.

It is true that woman-power has been revealed as a resource to be reckoned with, and that motor-power and mechanical implements are being more and more resorted to in tillage operations. But in the first case, it is to be hoped for the well-being of generations yet unborn, that women will not be compelled by necessity to devote their lives to hard physical work; and in the second case, machines need human beings to direct and control their operations.

Apart from the above considerations, an aspect of the question concerning the supply of man-power touches West Indian conditions still more nearly. It has been stated so often as to be a truism, that the labour supply in the tropics is generally unsatisfactory owing to one or both of two reasons. Either the population does not increase, even where there is ample scope for enlarged crop production, thus preventing extension, or even where there is a large population, the people are inefficient workers, lazy and indifferent. These charges may be admitted to be true for the most part. Some of the reasons for this state of affairs have been discovered in recent years.

Modern research has fully proved that the depreciation of working power observable in the tropics among all races inhabiting them, white and coloured, arises largely from the endemic occurrence of enervating—though not necessarily fatal—diseases, and that these diseases can be combated with success by attacking their causes. The chief of these endemic enervating diseases

are malaria—caused by the carrying of pathogenic protozoa from the infected subjects to others by various species of mosquitoes (*Anopheles*),—and ankylostomiasis—caused by the presence of the hookworm in the intestines of human beings.

With regard to this latter, it is sufficient to remark that it is essentially a filth-borne disease, and that strict attention to personal cleanliness, and to the proper disposal of human excreta, would lead to its extermination. That such measures, combined with the treatment of infected persons are effective, not only for the control, but for the eradication of ankylostomiasis in districts formerly badly infected, has been amply proved by work performed in this direction under the auspices of the Rockefeller Foundation, not only in the United States but in other countries also.

The serious loss to agriculture from the presence of malaria in any given district arises not so much from the actual deaths which result from the disease or its complications, as from the reduced crop returns owing to the loss of the labourer's time, and the reduced efficiency of the labour, owing to the loss of vitality and energy which follows on recurring attacks of this disease. This, as was noticed above, hinders the development of large areas of fertile land. The losses by death occur owing to the fact that the enervating results of malarial attacks predispose the subject to other more fatal diseases.

In a paper read before the Southern Medical Association at Richmond, Virginia, in November 1914, Mr. D. L. van Dine, of the Bureau of Entomology, United States Department of Agriculture, gives some striking facts on the above points.

An estate was selected in Louisiana for studies in malaria and its consequences. The estate consisted of 1,800 acres of cultivated land, and 1,700 acres of swamp land in timber. No less than 1,911 acres were being cultivated by seventy-four negro tenant-farmer families, giving an average acreage of 16 acres to each family. The total number of the members of these families was 299, or an average of four persons to each family. This fact seems to point to another result of malaria, for it is evident from the average family that the population on that estate was not increasing.

In the crop season, from May 1 to October 15, 1914, out of the seventy-four families, forty-eight were treated by the doctor for malaria, and the number of days lost to work amounted to 970 of actual illness, or counting the work of an adult woman or a lad between twelve and eighteen years of age as half that of an adult male, while the work of a boy between eight and twelve years old was reckoned as a quarter, the loss was computed as 625·5 days of adult men's work. It was also the opinion of the investigator that there were many cases which were not reported, but were treated with 'mixtures' prepared at home, and by 'taking a day or two off.'

An effort was made to form an estimate of the labour loss occurring from the numerous cases of malaria not reported to the doctor. It was computed that, without any error on the side of exaggeration, there were 487 days of illness from this cause not reported, or 250·75 days of adult work lost.

Time is also lost by the adult members of a family in attending those who are ill. From the record of time lost due to this cause, it appeared that 385 days, or 235·5 of adult work, were to be included under this head.

During the crop season for which the records were kept there were 1,457 days of actual illness among members of the tenants' families, making a loss of 1,842 days, representing 1,066 days of adult labour. There were 166 separate attacks among 138 persons out of the total of the 299 members of the families. Each malarial attack averaged 8·77 days of illness, or 6·42 days of adult work for each case of malaria.

This actual loss of over a thousand days of work during the crop season is a significant fact in view of the possibility of controlling or eradicating malaria, and thus making possible a great increase in the available man-power for the development of the agricultural resources of the tropics.

The means of combating this loss consist of curative measures during attacks, which may be left to the physicians—though it cannot be too widely known that quinine, in some form, is the antidote to malaria—and of prophylactic measures, consisting in destroying the Anopheles, chiefly in its larval form, and in warding off the bites of the adult female insect. As regards these prophylactic measures, steps have been taken in most of these West Indian islands to do something in this direction, but more vigorous efforts are needed, and more study of local conditions affecting the life-history of any particular species of Anopheles requires to be undertaken. Mr. van Dine points out that the treatment of the disease for long periods of time in malarial regions has

not reduced the malarial rate, except where prophylactic measures have been taken. The disease is well understood and treated by physicians. The fact that malaria continues, then, in certain localities, is due, not to lack of treatment of the disease, but to the lack of control of the mosquitoes that convey it. It has been proved that where areas of land have been drained and brought under cultivation, malaria has decreased in proportion to decrease in collections of surface water in which the larvae of malarial mosquitoes thrive. Drainage is, then, one great prophylactic; and another is so to cover or screen the surface of standing water, either by a film of kerosene or by mosquito-proof wire netting that the female insects are prevented from obtaining access to their breeding places, or that the larvae are smothered. Some suggestions on this point were given under Insect Notes in the *Agricultural News* of July 27, 1918. It must be emphasized that these prophylactic measures are too variable to be standardized, and as Dr. Samuel T. Garling, Chief of the Laboratory of the Board of Health of the Panama Canal Zone, stated in 1914, 'each region and each locality must be studied by itself, even though the region contains Anopheles, the bionomics of which for other regions are well known.'

Among West Indian islands Barbados enjoys the reputation of being free from malaria, there being no species of Anopheles found in that island. This has been conjectured to be due to the presence of small insectivorous fish (*Girardinus poeciloides*)—locally known as 'millions'—in all natural collections of standing water. In regard to the influence of this factor, it may be noticed that, in his investigations already referred to, Mr. van Dine found that in open collections of water of a permanent character, having margins free from vegetation or trash, the minnows and the predaceous aquatic insects were very effective in controlling the larvae of Anopheles. Wherever, on the other hand, the margins were grass-grown, or the water shallow enough to support aquatic vegetation, or when trash, stumps, brush-wood, or other debris was allowed to accumulate on the surface, the larvae were found to thrive in the presence of even numerous fish. The absence of Anopheles from Barbados cannot be adequately explained on these lines.

To sum up. Seeing that malaria is responsible to a large extent for the depreciation of working power in mosquito-infested lands such as are most of the West Indies, and that man-power is more than ever needed for the well-being of the whole world, especially in agriculture, it is a matter of necessity that every effort be made to control and eradicate the carriers of this enfeebling and enervating disease.

With regard to ankylostomiasis, the Rockefeller Foundation has been doing splendid work towards its eradication—Jamaica, St. Vincent and St. Lucia being among the fields where the officers of this philanthropic institution are at work. The inhabitants of the West Indies, however, must combine to spread the knowledge of hygienic principles among all classes, and to put these principles into practice, so that a disease so easily eradicated by cleanly habits may disappear from our midst, to the enhancement of man-power and energy. The greatest obstacle to improvement is the general and somewhat fatalistic acquiescence of the population in things as they have been and are.

AGRICULTURAL DEVELOPMENTS IN JAMAICA.

The Jamaica correspondent of *The Times Trade Supplement*, October 1918, writes, with regard to agricultural devolopment in that Colony and in British Honduras, that banana growers in the eastern section of Jamaica are turning their attention to cane cultivation. A public meeting was held recently in one of the eastern townships, when it was decided that the Government should take up the question of a State-aided sugar factory in that area for the development of the cane industry.

The doctrine of co-operation is being preached in every British possession in this quarter of the globe. The Jamaica Imperial Association and the Agricultural Society are doing all they can to bring all sections of the people in Jamaica together for the advancement of the country, and societies in the other colonies are working on similar lines. It is safe to say that the future of these possessions of the Crown depends on the development of the soil. Want of cohesion has been a serious difficulty in the past, but it now appears that West Indians in general are on the threshold of a new era. In British Honduras an association has just been formed for the following objects: (1) to grow ground provisions, grains and other foodstuffs; (2) to approach landowners of whom cultivators are tenants, asking for a reduction of existing rents; should this request be refused, to secure Crown lands for the planting of staple crops, like cacao, coco nuts, coffee, oranges, and other citrus and tropical fruits; (3) to give mutual assistance to one another in preparing the land and planting same; (4) to raise stock.

The *Demerara Argosy*, October 13, 1918, states that the Governor of the Colony has advised the Governments of Trinidad, Barbados, and other islands which His Excellency had agreed to supply with rice, that owing to the drought now prevailing in the colony, and which is likely to continue, there will be a shortage in the rice crop, and as a result it will not be possible for him to allow any further export of the commodity.

THE INDIAN CORN INDUSTRY OF ST. VINCENT.

The following information relating to the Indian corn industry of St. Vincent, especially in regard to the recent developments which have taken place in connexion with efforts to increase the production of local foodcrops, is abstracted from notes forwarded to the Head Office by Mr. W. N. Sands, the Agricultural Superintendent.

Indian corn (maize) had always been grown in the colony as an intermediate or catch crop with cotton, arrowroot, sugar-cane, and ground provisions. It was no doubt one of the earliest food-plants cultivated by the original Carib inhabitants. Previous to recent developments the bulk of the corn was consumed locally, but a small quantity was annually exported to neighbouring colonies. The exports for the period 1904-14 averaged 564 bushels per annum.

Towards the end of 1914 the Government of St. Vincent, viewing with alarm the depressed condition of the markets for cotton and arrowroot, the chief products of the colony, consulted with the Imperial Commissioner of Agriculture as to the prospects of a corn industry, as it was desirable, under the circumstances described, to diversify still further the local crops.

In February 1915 Sir Francis Watts outlined a scheme (a) for the erection of corn shelling and drying machinery at the Government Ginnery on similar lines to that in operation in Antigua; (b) the establishment of a system of corn-purchase on a profit-sharing basis such as was in operation with cotton; (c) offering to growers facilities for shelling and drying corn. Acting on the advice of the Imperial Commissioner, the Government decided to erect a Granary, and to advocate the growing of corn wherever suitable land for this purpose was available. This machinery was obtained from the United States of America early in 1915, and was installed in a special shed adjoining the main building of the Government Ginnery. The total cost of the Granary, with buildings, machinery, and bins, was £600. The cost would have been much higher had it not been possible to connect the machinery to the main driving shaft of the ginnery, and thus use steam from the boiler.

As the result of experiments for the selection of a uniform yellow corn, 620 lb. of the native yellow corn was distributed from the Experiment Station during the year 1916 to the chief planters. The good results of planting this selected seed were demonstrated at the granary when the 1916-17 crop was dealt with. A special study of the insect pests of corn was made by ths Assistant Agricultural Superintendent, and effective methods of control of certain of the most notorious of these were devised. The Agricultural Superintendent, by means of lectures and leaflets, was successful in arousing much interest in the industry. These efforts, together with the incentives to production, led to a considerable increase in planting.

The bulk of the crop was grown as a catch crop with cotton and arrowroot, but more particularly with the former. With arrowroot, corn is grown after the arrowroot has been reaped. The newly dug fields, especially those which are harvested in the last three months of the year, are sown with corn. Experiments in planting at different distances with corn as the sole crop showed that the most satisfactory results were obtained when the corn was planted on 4-foot banks in rows with single plants 1 foot apart. Satisfactory returns were also obtained by planting on 3-foot banks with one row on the bank, and the plants singled out to one in the hole, the holes being 1 foot apart. It was found that when corn was planted as a catch crop, and the distance between the holes was about 6 feet, four plants to a hole could be safely left and would give good results if the distance between each plant was 9 inches; in other words, it is a better plan to sow the seed separately than to drop four or five grains together in a hole.

The total quantity of corn dealt with during the past two seasons, in terms of undried or wet grain, was in 1916-17, 128,598 lb. or 2,296 bushels; in 1917-18, 295,908 lb. or 5,284 bushels. Under the profit-sharing scheme the payment on account was $1·50 per 100 lb. for shelled corn, and $1·12 per 100 lb. for cob corn. For the 1916 17 crop, the payment on account and the bonus netted the venders 2½c. per lb. of wet corn. The transactions of the 1917-18 season are not complete, but a much higher final payment than this is likely to be made. The amount advanced was the same as in the previous season.

The exports of corn for 1915, 1916, and 1917 were 1,518, 1,652, and 2,855 bushels, respectively. The exports are relatively small, but it is of interest to add that during the 1917-18 season, 55 tons of corn were shipped to the United Kingdom, and realized prices satisfactory to the shippers. As, owing to the war, a larger proportion than usual of the crops of the past three years has been consumed locally, it is not possible to ascertain the total ouput in each season.

The Granary has proved a valuable asset to the people of the colony, in that it made possible the maintenance of a supply of valuable cereal food in the form of corn meal for use at times when imported breadstuffs were restricted and expensive, and locally produced foodstuffs scarce and dear. In the months of June and July 1918, the output averaged 8,000 lb. per week.

The industry has been placed on a sound footing, and it is hoped that the substantial progress already made will be maintained from year to year.

BRITISH SUGAR MACHINERY MANUFACTURERS' ASSOCIATION.

A Sugar Machinery Manufacturers' Association has been formed in Great Britain by the leading companies and firms in the industry there, who have followed the recommendations of the British Ministry of Reconstruction, that all trades form organizations to facilitate the distribution of materials and to carry out other common purposes.

A statement issued in behalf of the new association points out that cessation of the import of beet sugar from Germany and Austria has rendered the United Kingdom entirely dependent upon the tropics for sugar, and that there has been an urgent demand for cane-sugar machinery. The Government has taken over the control of the whole engineering industry, in the interests of munitions production, and it has, therefore, been necessary to get special permission to employ metal materials or to export machinery containing such materials. It is considered that the questions thus raised can be better discussed in official circles from the point of view of an associated industry than from that of individual firms.

There is, moreover, a clear field of usefulness for this association during the problematic period following the war. On the one hand, it will continue to be necessary for British makers of sugar machinery to do their utmost to assist the development of the cane-sugar industry, while, on the other hand, it is to be expected that for some time there will arise questions of priority and precedence in regard both to supplies of metal and to shipping accommodations.

The Sugar Manufacturers' Association is affiliated to the British Empire Producers' Organization which is determined to oppose the resumption of importation from Germany, and which is therefore actively interested in the increase of production in the Allied and neutral countries. The machinery makers are vitally concerned in this policy, and the whole purpose of their collective action as an association is to enable them to co-operate more efficently with the sugar-growers on tropical estates, with whom they have had cordial relations for so many years, and also to deal effectively with the design and supply of machinery for the manufacture of beet sugar in the United Kingdom and other countries. (The *Australian Sugar Journal*, August 8, 1918.)

TRACTORS IN HAWAIIAN CANE FIELDS.

The *Australian Sugar Journal*, August 8, 1918, says that the furrowing-out of cane fields preparatory to the planting of cane is one of the most difficult kinds of work in connexion with the raising of Hawaii's most important crop. Formerly mules were employed in this task on nearly all of the plantations, but practical tests have convinced one of the leading Hawaiian sugar companies, the Ewa Plantation Company, that this work can be done more efficiently and economically with the Caterpillar tractor.

When mules were used for furrowing-out, eight or even ten mules were required for each plough. Ten mules could pull a single plough cutting a furrow of the required depth in most of the ground; with eight mules to a single plough the strength of the animals was severely taxed, and frequent stops to rest them were necessary.

When the Holt Caterpillar '45' was tried out in this work, it had no difficulty in pulling two of the same big ploughs. It had formerly taken the mules forty-five minutes to make one trip across the field where the tractor was tried. The tractor makes the same trip in nine minutes, and could make it in even less time if the men handling the ploughs could stand a faster pace.

In four days the Caterpillar '45' furrowed a field that it had formerly taken two weeks to furrow with mules. From centre to centre of the furrow measures 66 inches.

Furrowing is not, however, the only use to which this tractor is being put at Ewa. During the harvesting of the cane crop it is employed to haul trucks loaded with cane over the ridges formed by the ploughing. It is one of the advantages of the Caterpillar tractor that it can work over rough ground where tractors of the ordinary type cannot be used.

The extent to which the tractor is winning its way on the Hawaiian plantations has been much commented on recently by the newspapers of the Islands. The *Pacific Commercial Advertiser* recently called attention to the fact that, whereas five years ago there were only three tractors in all Hawaii, at the present time there are well over 100. It adds: 'The majority of the plantations that have purchased one or more tractors as experiments have followed quickly with orders for more, and hardly a manager who mentions that his plantation is equipped with tractors but adds that more have been ordered.

'Ploughing, furrowing, cultivating, hauling cane cars and waggons, and a dozen other uses, are being found for the tractors on Island plantations.'

It is estimated that there are about 140 tractors of different types in use at the present time among the plantations of Hawaii, of which nearly 75 per cent. are Caterpillar tractors.

THE PROPERTIES OF CORK WOOD.

In the *Agricultural News* for June 29, 1918, attention was drawn to the demand in certain quarters for light woods. An interesting note concerning the uses to which it is suggested that cork wood (*Ochroma lagopus*), or as it is known in the American timber market, 'balsa' wood, may be put, appeared in the *Proceedings of the American Society of Civil Engineers*, Vol. XLII, No. 6, August 1916. In the course of a discussion at a meeting of that Society on a paper read by Professor Carpenter, Mr. A. P. Lundin said that his attention was drawn to this wood many years ago during voyages to tropical countries. He first remarked it when he saw a number of natives come floating down a river on a raft made of balsa logs. The natives in parts of Central and South America used such rafts to float their produce down the rivers to the seacoast. They seldom use them, however, more than once, because in the first place it would be difficult to bring the raft up against the stream, and because the wood in question absorbs water so very readily that the raft is more or less water-logged after its one journey.

Mr. Lundin went on to say that later on his attention bad been drawn to some crude attempts made to use balsa (cork wood) in life-belt manufacture; but it was found that the wood absorbed water so rapidly that the belts had to be made two or three times as large as the ordinary cork life-belt to assure the required buoyancy. After several unsuccessful attempts to devise methods for making the wood non-absorbent, it was found that Colonel Marr's water-proofing process could be successfully and practically applied for this purpose.

The United States Government has tried balsa life-belts, life-buoys, etc., as compared with the same articles made of cork, for a period of forty-nine days (twenty-four hours per day), at the end of which period the cork belt had lost all its buoyancy, while the balsa belt still retained the buoyancy stipulated in the Government's requirement.

Owing to the fact that the peculiar structure of the balsa wood rendered it suitable for such articles as life-belts, it was considered a few years ago that it might also be adapted for insulation purposes, and accordingly experiments in that direction were begun. The first ice box made with the new material gave surprising results. During hot summer weather ice was put into the box on Friday or Saturday, and on the following Friday or Saturday the temperature in the box would still be quite low, and some ice still left unmelted.

A small ice box or 'pony refrigerator', made by an American company, is stated to be of balsa wood 2 inches thick. The box is about 36 inches long, 31 inches wide, and 22 inches deep, and weighs about 30 lb. It is stated that such a box could not be made of any other known insulating material. It is strong enough to stand severe jars, and a man could jump on it without straining it unduly.

A small container on the lines of a thermos bottle, but in the form of a box made of 1-inch material, and which has the capacity of about 1 cubic foot and weighs 6 lb., has been used to send butter all the way from Virginia to Southern California. The average outside temperature during the trip of eight days was 82° F., yet when the boxes arrived at Los Angeles the butter was still hard and frozen. Mr. Lundin considers that there are many uses, especially as a most efficient insulator, to which balsa wood will be increasingly put in the near future.

CASSAREEP.

As is well known, the juice of the cassava or manioc root is, in its raw condition, very poisonous. This same juice, however, when boiled down, becomes an ingredient of various sauces, and is known throughout the West Indies as 'cassareep' or 'cassaripe'.

In this part of the world, although it is manufactured locally in small quantities in most of the islands, Demerara alone seems to have export trade in this article.

Its preparation is simple. In Guiana the cassava roots, after being peeled, are washed and grated. The resulting pulp is then placed in long, flexible, cylindrical baskets or filters, which are plaited by the Indians from a local fibre. The pulp placed in one of them is compressed more and more as the basket elongates. One end of the basket is attached to a beam or prop, and to the other end a weight is attached. Under the influence of the compression thus caused the cassava juice is pressed out through the interstices of the filter, and is collected in a receptacle placed beneath the weight.

When the juice has ceased to flow, the grated mass within the filter is taken out and dried thoroughly. The dried flour is known as 'farine', from which the tasty cassava biscuits are made; it is also cooked in many other ways. The collected juice is then boiled down, with the addition of a little salt, to the consistency of treacle or molasses. In its raw state the juice is a somewhat opalescent, milky fluid, but when boiled down into cassareep it is a dark-brown, sticky stuff. In the West Indian islands where the special baskets mentioned above are not obtainable, the grated pulp is placed in a bag of coarse cloth, and wrung or pressed until the juice is extracted.

It must always be remembered that the juice must be thoroughly boiled down so as to destroy its poisonous qualities. If so prepared, cassareep is a valuable accessory in the kitchen for the preparation of sauces. It is also the basis of the dish known in the West Indies as 'pepper pot', into which all kinds of odds and ends of meat left over from meals, and which otherwise would be wasted, may be placed. Owing to the preservative effect of the cassareep, a pepper pot may be kept going for years, if only it is daily brought to the boil. It is said, although one would not vouch for the literal truth of the statement, that in Demerara there are pepper pots which have been handed down from father to son for at least three generations.

ORANGE WINE.

In the *Agricultural News*, October 19, 1918, there was a note on the manufacture of wine from oranges in British Guiana. Considering that in some of the West Indian islands, as for instance, in Dominica where orange oil is expressed, there must be thousands of oranges the juice of which is thrown away, it would appear that if this juice could be utilized for making wine, even for local consumption, it would be an advantage.

Orange wine is said to be a good tonic of agreeable flavour, and what is more, a perfectly pure, unsophisticated wine of low alcoholic content. In case any of our readers should care to make experiments in this direction, the following recipes for the manufacture of orange wine are reproduced from a book entitled 'Florida Fruits', by Helen Harcourt, in which the writer advocates the manufacture of this wine from unmarketable fruit.

From the directions given—especially those in recipe No. 3—it would appear that almost anyone in the possession of even a small quantity of oranges might make such an experiment. It need hardly be added that scrupulous cleanliness must be observed in all the appliances and utensils employed.

ORANGE WINE. NO. 1.

Take perfectly ripe, sweet oranges, the riper the better, as then the saccharine matter is entirely developed; peel, and cut into halves across the segments; cut over a tub so as not to loose any juice, and squeeze both halves hard before dropping into the tub. When the tub is full, put the whole mass through a wire press, which must be so close that none of the seeds can escape into the mash, as they would give the wine a bitter taste. To each gallon of juice add 1 lb. of granulated or loaf sugar, and to each gallon of this mixed juice add 1 quart of pure water. Put the whole into a barrel, leaving a space of about 5 gallons for expansion of the wine during fermentation.

Orange wine has to undergo the lower fermentation, as by the upper fermentation all the volatile matter and the aroma would escape. The barrel must be closed air-tight, and a fermenting tube adjusted; the fermentation is very vigorous for the first few days, and the barrel must be closely watched to prevent its bursting. The fermentation subsides gradually after a few days, then the wine has to be racked off, and the lees can be filtered; the fermenting tube must be adjusted again to the new barrel, to remain until the fermentation shall have ceased entirely. Rack the wine off again in about six weeks after the latter period, and in a month after this second racking it will be fit for market, as there is no second or 'spring' fermentation, as with grape wine.

ORANGE WINE. NO. 2.

Ninety sweet oranges, 32 lb. of lump sugar; break sugar in small pieces and put in a dry, sweet 9-gallon cask; place the latter where it is to remain. Have ready close to the cask two large pans or small tubs, put the orange peels pared thin into one, and into the other the pulp, after the juice has been squeezed from it; strain the juice carefully and put it into the cask; then pour 1½ gallons of water on both peel and pulp; let it stand for twenty-four hours, then strain into the cask; add more water to peels and pulp; next day strain into cask. Repeat this process until the cask is filled, which should take just seven days to accomplish, the water being properly proportioned to this end, and the contents of the cask being stirred each day. On the third day after the cask is full, it may be securely bunged down.

This is a very simple and easy method, and if directions are followed the wine can not fail to be excellent. It should be bottled in eight months, and will be fit for use twelve months after making.

ORANGE WINE. NO. 3.

Juice of sweet oranges and water, equal parts; to every gallon add 3 lb. of raw sugar; place in tight barrel, filled, with a bent tube from the closed bunghole to a pail of water. When the gas bubbles cease to show in the water, close the barrel; leave it undisturbed for four months, then bottle and cork tight. This makes a very fine wine that will keep well in wood or glass.

Orange wine is of an amber colour, tastes like dry Hock, but always retains a decided aroma of the orange.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

VIRGIN ISLANDS. The Curator, Mr. W. C. Fishlock, writes to say that the work of cotton planting has been greatly delayed by lack of labour, and by unfavourable weather. Plant distribution during the month of September consisted of 39 lb. of cotton seed sold. Owing to long spells of dry weather the condition of the cotton crop is not altogether good, and there has been a large percentage of boll-shedding. The earlier planted plots of ground provisions have been reaped, and consequently, provisions are not as plentiful as they were a short time ago. On account of the high prices prevailing in St. Thomas, there is still considerable activity in the planting of sweet potatoes and similar crops. Rain fell in measurable quantity on sixteen days of the month. The total precipitation at the Experiment Station was 5·92 inches as compared with 4·81 inches, the average for the month for the preceding seventeen years.

GRENADA. The monthly report of the Agricultural Instructor for September last has been received at this Office. Under Notes on Peasant Agriculture it is mentioned that the cotton crop gives signs of being very good. The good work begun years ago by the Government in the improvement of horse breeding in Carriacou is said to be showing marks of decline, due largely to the fact that inbreeding is being practised on a somewhat large scale; and the probability of the creole horse reverting in the next few years to the type from which his improvement began is emphasized. Thrips continues to be prevalent, while rats have been and are still very destructive to grain, so much so that a committee has been appointed by the Agricultural and Commercial Society to enquire into and report upon the matter of beginning a co-operative campaign for the reduction of these rodents. The cultivation of the sugar-cane as an industry is being revived in Carriacou by a large landed proprietor. During the months of June, July and August, mahogany logs to the value of £146 were shipped from the colony. The present prices for mahogany timber offer, it is thought, sufficient inducement to persons, owning lands which cannot successfully grow other crops, to put in mahogany seedlings to supplant the trees that have been cut down. Stormy weather accompanied by thunder and lightning prevailed from September 16 for some days. The earlier part of the month was very hot, and despite the rains, heat characterized the latter part also.

AGRICULTURE IN BARBADOS.

The heavy rains with which October began ceased on the 18th. Since that date only showers have fallen, totaling in general about 1½ inches.

The rainfall for last month has, however, been sufficient in every part of the island, except perhaps in the seaboard part of the parish of St. Lucy.

The total average rainfall for October is about 7½ inches; of this, about 6½ inches were registered during the first eighteen days of the month, when rain fell almost continuously. This total is less than last year's, and considerably under that recorded in October 1916. The difference has, however, been more than made up for by a seasonable distribution.

The plant canes of the island are in excellent condition They are green and free from disease, and the bunches are full. The length of cane also is most satisfactory, and the October shoots are numerous and healthy.

At the present stage the crop is, in our opinion, as promising as in 1915, at least as far as plant canes are concerned. But, of course, a good deal depends on the weather of the next two and a half or three months.

We learn that the beetle pest is not so troublesome as last year. In the districts in which this pest appears in large numbers planters have co-operated, and persistently collected the beetles during this season. They have taken the warnings sounded by the Government Department of Agriculture and their labours have not been in vain.

The ratoons in many fields in the red soil are poor. Their vigour has not been maintained, and it is clear that they will not develop much more. There are, of course, some splendid fields of first ratoons, but the second ratoons are those to which we principally refer. There are some estates on which a change will be introduced whereby only first ratoons will be kept. This was the system which generally obtained forty years ago when the Bourbon cane was grown. Like the Bourbon, the new varieties give a good return as plant canes, and the soil is not equal to the strain of second ratoons.

The tillage for the fast-approaching planting season is fairly well advanced in the black soil districts, and the planters are straining every effort to manure their fields before the canes are planted.

This planting season will practically see the B.376 discarded, while the B.H. 10 (12), the Ba. 6032, and the B.6450 will be patronized according to the success with which their growth has been attended in the different districts of the island.

The ripe fields of potatoes are being sold with some rapidity so as to clear the land for cane planting. Potatoes have been sold as cheap as 16lb. for 10c., but 12 lb. for 10c. is the more usual price.

The yams have had ideal weather and show promise. Both yams and eddoes of two or three kinds are being sold in limited quantities. There is an eddo, called the China eddo, which matures very quickly, and which might be more generally planted.

The breadfruit crop, which has rendered such opportune assistance to the food supply, is now drawing to a close. The Indian corn crop has been practically reaped, and is being sold at 9*s.* per bushel. (The Barbados *Agricultural Reporter*, November 2, 1918.)

DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture left Barbados on November 7 for the purpose of paying an official visit to Antigua. Sir Francis Watts is expected to return to Barbados early in December.

At the request of His Excellency the Governor of Trinidad, Mr. W. Nowell, Mycologist on the Staff of the Imperial Department of Agriculture, has been assigned to collaborate with Mr. C. B. Williams Entomologist in charge of Froghopper Investigations in an examination of the relation of root disease of sugar-cane to froghopper damage. Mr. Nowell is expected to leave for Trinidad early in December, and to return about the end of January.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

CLERICAL STAFF.

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Typist	Miss B. Robinson.
Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

**Seconded for Military Service.*
†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

The editorial draws attention to the loss of daily work in most of these West Indian islands, which is due to endemic diseases, to a great extent preventible.

Under Insect Notes, on page 362, appears a review of a recent report on cacao thrips in Grenada.

A scheme of classification for parasitic plant diseases, and a note on the Panama disease of bananas in Cuba, appear on page 366.

A short article on the making of orange wine will be found on page 358.

Peace within Sight.

In common with the Mother Country and her Allies, the West Indian colonies are all rejoicing this week at the complete success of the Allied Forces. These islands have been very fortunate in escaping the miseries and great privations that have befallen the countries within actual reach of German barbarity. They too, however, proudly mourn many of their most promising sons, who have made the great sacrifice for justice and liberty. Their privations and discomforts have been comparatively slight, and West Indians of all ranks have borne them well for the most part. It is to be hoped that all classes in these islands may stand the reaction of the ensuing period of readjustment as calmly and well. As was pointed out in the editorial of the *Agricultural News*, January 26, 1918, plenty is not likely to follow peace so immediately as some people imagine. It is the duty of every member of the Empire to continue to maintain the intensive production and economical use of all the commodities needed for the reconstruction of industry and the resumption of normal conditions of food supply.

The American Agricultural Committee.

The following interesting information is reproduced from *Science*, October 11, 1918. The United States Department of Agricultural announces the arrival in England of a committee of men familiar with food production and agricultural organization activities in the United States.

The committee will secure general information regarding food production conditions in England, France, and Italy, so that when they return they will be able to reveal the needs more effectively to the leaders of agriculture in the United States, and to farmers generally. They will also study agricultural problems in England, France, and Italy, including the use of machinery and the assignment of labour in farming operations, the live stock situation, the depletion of herds, and the probable extent to which Europe may call on the United States for live stock to replenish herds, the seed situation, the probabilities of securing supplies from Europe, and similar matters.

Openings for West Indian Trade with Canada.

The Government of Canada evidently desires to develop trade relations with the West Indies. This is shown by the following despatch recently received by the Imperial Commissioner of Agriculture for the West Indies from the Superintendent of the Commercial Intelligence Branch of the Department of Trade and Commerce, Canada, which is published as of interest and importance to West Indian readers :—

'With a view to encouraging the export of the natural products of the British West Indies to Canada we shall be glad to publish in the *Weekly Bulletin* of the Department of Trade and Commerce offers of West Indian products. We shall not publish the address of the West Indian exporter offering the products, but will number each offer, and in case we receive letters from Canadian houses asking for the address, we shall furnish it by private letter.

As our space is limited we could not publish a large number of offers in any one issue of the *Weekly Bulletin*, but we shall be glad to publish a few every week.'

It is requested that a separate letter be written for each subject under correspondence, and that all communications be addressed to the Commercial Intelligence Branch, Department of Trade and Commerce, Ottawa, Canada.

Anyone in the West Indies who may have commodities to place on the market, especially any products the market for which is not yet developed, would do well to avail himself of this opportunity of advertising, which the Canadian Government places at his disposal.

The Epidemic of Spanish Influenza.

The accounts received both from America and England of the widespread outbreaks of a virulent form of influenza, and of the serious consequences following attacks of the disease, have caused considerable apprehension lest it should spread through the West Indies. The following note, which is reproduced from *Science*, September 20, 1918, is of interest, and may be of use under the circumstances.

In an effort to prevent an epidemic of Spanish influenza throughout the United States, Surgeon-General Blue, of the Public Health Service, has provided a list of methods for the control of the disease.

Dr. Blue's bulletin of information on the disease, issued primarily for physicians, contains information as follows:—

Infectious agent—The *Bacillus influenzae* of Pfeiffer.

Sources of infection—The secretions from the nose, throat, and respiratory passages of cases or of carriers.

Incubation period—One to four days; generally two.

Mode of transmission—By direct contact or indirect contact through the use of handkerchiefs, common towels, cups, mess-gear, or other objects contaminated with fresh secretions. Droplet infection plays an important part.

Period of communicability—As long as the person harbours the causative organism in the respiratory tract.

Methods of control—The infected individual and his environment.

Recognition of the disease—By clinical manifestations and bacteriological findings.

Isolation—Bed isolation of infected individuals during the course of the disease. Screens between beds are to be recommended.

Immunization—Vaccines are used with only partial success.

Quarantine—None; impracticable.

Concurrent disinfection—The discharges from the mouth, throat, nose, and other respiratory passages.

Terminal disinfection—Thorough cleansing, airing and sunning. The causative organism is short-lived outside the host.

General measures—The attendant of the case should wear a gauze mask. During epidemics persons should avoid crowded assemblages, street cars, and the like. Education as regards the danger of promiscuous coughing and spitting. Patients, because of the tendency to the development of broncho-pneumonia, should be treated in well-ventillated, warm rooms.

Prince Bonaparte's Collection of Ferns.

A letter has recently been received by the Imperial Commissioner of Agriculture for the West Indies from the Custodian of Prince Bonaparte's Herbarium in Paris. A portion of this letter is reproduced below, as some of the readers of this Journal may take a fancy to make a collection of West Indian ferns, and forward them as requested. Ferns are among the easiest of botanic specimens to dry and press for herbarium purposes.

'His Imperial Highness who has devoted many long years to the study of ferns has established, in order to facilitate the determination of the pteridologic collections that may be entrusted to him, a herbarium, which at the present time contains 300,000 specimens.

'Being desirous of still increasing it by the addition of the ferns of your regions, allow me to ask you if you know any people who could gather and forward the said ferns to us. The more there will be the better.

'It is understood that we will pay the expenses of carriage, and that we will give the collectors the amount asked for their trouble. If you know any who are willing to do this, please give me their names and addresses so that we can write to them.'

Any letters or specimens are to be addressed to Monsieur C. Belhatte, Conservateur de l'Herbier de S.A.I. le Prince Bonaparte, 10 Avenue d'Iena, Paris.

A New Citrus Fruit of the Philippines.

An article in the *Philippine Agricultural Review*, Vol. X, No. 4, by P. J. Wester, gives an interesting account of the 'miaray', a new species of citrus, discovered by him.

Apart from a purely botanical point of view, new forms are at present also of great interest as opening up new possibilities in hybridization, especially in connexion with the problem of breeding new types resistant or immune to citrus canker (*Pseudomonas citri*, Hasse).

The 'miaray' (*Citrus miaray*, n. sp.), described and named by the author, was found by him in August 1917 in the interior of Mindanao, at an elevation of 750 metres.

With its willowy, slender, drooping branches, and dense crown of dark-green foliage, the miaray is an exceedingly handsome tree, about 6 metres in height. The fruit is about the size of a lime. It is pleasantly acid, and may be used like the lime. The clean, vigorous growth of the tree indicates that it is likely to prove a desirable stock for other cultivated varieties of the citrus.

INSECT NOTES.

REPORT ON CACAO THRIPS (HELIOTHRIPS RUBROCINCTUS) IN GRENADA IN 1917.

This report contains an account by Mr. F. W. Urich of a visit in 1917 to Grenada which was made at the request of the Government of that island.

The title of the report is 'Thrips, Black Ants, and other Insect Pests of Cacao in Grenada, and a note on Coco-nut Disease, Report presented to the Government of Grenada by F. W. Urich, Entomologist, Board of Agriculture, Trinidad.'

Mr. Urich's occurrad during the period August 18 to September 25, 1917. It appears to have resulted from a somewhat more extensive occurrence than usual of thrips (*Heliothrips rubrocinctus*) during the latter part of the year 1916 which caused members of the Agricultural and Commercial Society to view the situation with alarm. The attention of the Government was directed to this serious menace to the staple industry of the island, and in a resolution dated November 29, 1916, the hope was expressed that Mr. Urich's services might be obtained for a few weeks at as early a date as possible.

During his visit Mr. Urich inspected cacao in most parts of the island, and gave spraying demonstrations in several districts.

As far as the information regarding thrips is concerned, the report contains nothing new. Mr. Urich found that thrips probably occurs on every cacao estate, but that its serious attacks appear to be confined to the southern and western parts of the island.

With regard to the status of thrips in Grenada, Mr. Urich found himself at variance with the frequently expressed opinion of the officers of the Imperial Department of Agriculture. He states that 'the position of thrips is that of a first class primary pest of cocao, which demands serious and united attention on the part of all cacao planters, especially those in the western and southern parts of the island. While good cultural methods will help to keep down the numbers of thrips, this is not enough, and regular spraying must be resorted to. It is the only sure way of keeping it in bounds and preventing it affecting the cacao crops.'

Under the heading 'Recommendations', the following statements occur: 'if thrips are to be kept under in the island a universal campaign is necessary, and every planter and peasant proprietor should endeavour to spray his cacao trees for thrips at the right time. . . If spraying is not taken up universally, then the Government may consider the advisability of introducing such measures as it sees fit to make the control of thrips by spraying compulsory for all. Stress is put on spraying, as it is the writer's opinion that although thrips can be controlled to a certain extent by cultural methods, it is absolutely necessary that it be sprayed also.'

In 1900 Mr. Maxwell-Lefroy, the Entomologist on the Staff of the Imperial Department of Agriculture, considered thrips a possible enemy to cacao rather than an actual pest. He recommended spraying as an emergency measure, and advocated good cultural methods for keeping the health and vigour of the cacao trees at the highest level, and the thrips at the lowest. For the past seventeen years this has been the steadfast policy of the Imperial Department of Agriculture, as is shown by all the published accounts of cacao thrips, and all references to this insect in connexion with its occasional outbreaks.

In 1915 the writer of this review went further, and stated that outbreaks of thrips indicate that something is wrong with the attacked trees, and that thrips, in Grenada at least, ought to be considered a useful insect, because its presence is a certain indication that the trees are suffering from some untoward condition. (Vide *Agricultural News*, Vol. XIV, p. 314.)

The factors which may affect cacao trees, and are observed to result in enormous increase of thrips, are root disease, unfavourable soil conditions, including shallow, infertile soil, lack of drainage or improper drainage, lack of organic matter in soil, lack of proper shade for plants and soil, exposure to wind, or any other cultural or environmental condition which affects the health of the tree.

Cultural treatment of cacao plantations for the control of thrips is fundamental, and may reasonably be expected to reduce the numbers of this insect to such a point that spraying will only be necessary under exceptional circumstances, and at widely separated times. As an insect, thrips is present on nearly every cacao tree in Grenada at almost all times, and it also occurs on several other trees; but it is only at certain times in certain districts, or even on certain trees, that outbreaks occur, and the same trees and the same localities are the sites of their development year after year.

Once the outbreak has fairly started, however, the insect, favoured by the condition of the trees in the thrips 'patches' or 'areas' where it may be said to be endemic, breeds to numbers beyond the capacity of these trees to support, and they may extend to the surrounding trees, and the more general occurrences or epidemics take place.

There are in Grenada many areas in which thrips appear never to have occurred to such an extent as to cause appreciable loss of crop or apparent injury to the trees, although it appears that these trees at most times carry a few thrips, and are in some cases in close juxtaposition to areas which have been severely attacked.

In the report under consideration it is stated that 'the pest is not widespread yet, but as it may become so it is necessary that it should be controlled before it gets out of hand.'

In 1900 thrips occurred in all parts of the island, even as in 1917, and although during that period of seventeen years no continued, systematic spraying for the control of thrips has been practised for any length of time, Mr. Urich states that the pest is not 'widespread yet.' During the same period the exports of cacao have risen from 53,000 bags in 1900 to 77,000 bags in 1917. The crops for the years 1916 and 1917 were the largest in the history of the cacao industry in Grenada.

The following figures show the amounts of cacao exported from Grenada in each year from 1900 to 1917:—

Year.	No. of bags.	Year.	No. of bags.
1900	58,388	1909	67,329
1901	53,887	1910	73,863
1902	61,286	1911	67,144
1903	63,019	1912	70,082
1904	67,225	1913	63,456
1905	64,319	1914	65,510
1906	54,381	1915	62,166
1907	60,089	1916	76,980
1908	64,398	1917	77,275

The cacao industry has made this progress over a long period of years without any remedial measures being applied other than the improvement of cultivation, which has naturally resulted from extended experience and increased know-

ledge of the requirements of the trees on the part of the planters. The Government is not likely to be greatly attracted a policy of compulsion to control an insect which, on the whole, has not seriously interfered with the development of the industry.

Mr. Urich can be supported in so far as his recommendations are to the effect that every cacao planter ought to supply himself with spraying apparatus, which he should know how to use, and with insecticides, the use of which also he should understand, and he should be energetic in spraying, whenever thrips develop to such an extent as to cause actual damage, either in the amount of the crop, or by injury to his trees.

In the section of the report under the heading 'Does Spraying Pay?', the result of an experiment carried out in Trinidad is quoted to show that spraying does pay. But the experiment was one in which a combined object was sought—the control both of an insect pest and of fungoid diseases. Bordeaux mixture and 'Black leaf 40' were used together, the former against the Phytophthora diseases (canker and pod rot), and the latter against thrips. There is nothing in that experiment to show that spraying for the control of thrips pays.

In the section of the report on black ants, Mr. Urich states that the 'black ants do no direct damage on the trees they inhabit, but they live on the secretions of scale insects, aphides, and other Homoptera.

The insect referred to is the acrobat ant (*Cremastogaster brevispinosa*, var. *minutior*), of which an account was given in the *Agricultural News* in 1914 (Vol. XIII, p. 298). In 1915 it was stated to possess great possibilities as a pest of cacao in that island in an abstract of a report on a visit to Grenada published in the *Agricultural News* (Vol. XIV, p. 314). This insect is a direct and serious pest of cacao and other trees. It invades pruning cuts, wounds caused by the breaking of branches or other injuries and attacks the living tissues of bast, cambium, and sap wood, preventing a proper healing over of the exposed surfaces, and is responsible for many cavities in the tissues of the trees.

SUMMARY.

Mr. Urich finds thrips a serious pest in Grenada, and makes very strong recommendations for universal spraying for its control. He considers this insect to be increasing in destructiveness. He believes that cultural measures for the improvement of the condition of cacao trees are useful, but not of fundamental importance.

The Imperial Department of Agriculture maintains that cultural measures are fundamental, and spraying a palliative, and that as the agricultural problems are resolutely faced and overcome, the necessity for spraying for the control of thrips will become less and less.

The argument to the effect that thrips is increasing in destructiveness in Grenada would seem to be met effectively by reference to the figures showing the amount of cacao exported for the past seventeen years, during which thrips has been known to occur in Grenada, while the figures for the years 1916 and 1917 appear to dispose of the serious menace to the staple industry of the island, which was complained of by the members of the Agricultural and Commercial Society. The crops of 1916 and 1917 were about 12,000 bags above the average for the ten-year period (1906-15) just preceding.

With regard to the black ant, Mr. Urich says it does no direct harm. In making this statement he apparently had in mind the harmful indirect action of the acrobat ant in protecting scale insects. The attacks of this insect on the tissues of the trees are very real and serious.

H.A.B.

HINTS FOR COOKING JERUSALEM ARTICHOKES.

Professor Cockerell, at the close of the article referred to on page 365 of this issue of the *Agricultural News*, gives the following directions and recipes for cooking Jerusalem artichokes, for which he says he is indebted to Mrs. Cockerell.

The tubers have a delicious aroma (due to essential oil) when cooking, and this should be preserved, as far as possible, by keeping them covered. They should be put in boiling water, a few tubers at a time, so as not to lower the temperature; steaming would probably be still better, reducing the loss of soluble contents. The boiling should continue fifteen to twenty minutes (possibly less at sea-level) when the skin is easily removed. At this stage the following recipes may be employed, but in the case of the salad (No. 2), the preliminary cooking should last a little longer:—

1. Soup may be made with the addition of celery tops rubbed through a colander, with milk, or stock, or cream added.

2. The cooked tubers, sliced with egg, or celery, or endive, served with French dressing or mayonnaise, make a delicious salad.

3. Slice the boiled or steamed tubers, cover with milk use salt and pepper to taste, cover with bread crumbs, and then bake for an hour. Grated cheese may be added to this dish.

4. Slice boiled tubers, and fry with steak or chops.

5. Slice boiled tubers, mash, and cream, salt and pepper, or cream them by adding sliced tubers to rich, white sauce, and serve with toast.

In Cuba, it is said, that the tubers, after being boiled, are mashed, with the addition of flour and seasoning to taste, and are then formed into cakes, and fried.

The Four O'Clock (Mirabilis Jalapa).—In the *International Review of the Science and Progress of Agriculture*, July 1918, there appears an interesting note on an article by a writer in *La Revista Agricola*, May 1, 1918, on studies made on a plant well known in the West Indies as Four o'clock (*Mirabilis Jalapa*). This plant was introduced from South America into Europe under the name of 'Marvel of Peru', and a description and a very accurate engraving of it is to be found in Parkinson's *Garden of Pleasant Flowers*, published in 1522. The West Indian name doubtless arose from the fact that the flowers always open about 4 o'clock in the afternoon.

The author of the article referred to above has made a long study on this plant, and concludes that its cultivation for various industrial uses is advisable.

When grown in gardens it flowers excessively, to the detriment of the seed, which is small. In arid soil, however, especially with ashes, it flowers less, and the seeds are much larger and richer in starch.

The stamens, pistils, and perianth (which dries up without separating from the seed) give a fast, purplish colour which dyes silk.

The starch contained in the seed is of very good quality. When freed from the husk and germs, the seeds give a fine flour which may be used for making bread, paste, biscuits, etc.; they may also be subjected to fermentation, as they contain a sugar.

The cultivation of this plant in malarial districts might be advantageous; the flowers open in the evening, and during the night give off a smell which is said to keep away or to stupefy mosquitoes, thus making them inoffensive.

GLEANINGS.

According to *The Times*, September 13, 1918, the area under wheat in England and Wales is 2 556,000 acres, and a production for this harvest may be anticipated of 10,500,000 quarters, or fully 3 300,000 quarters more than last year.

It is expected that the corn crop in Jamaica will finish much earlier that was anticipated. The dry weather has had a good deal to do with curtailing the production. In certain well informed circles it has been stated that the dry weather has caused a shortage of fully 33,000 bushels in the island's supply. (The *Jamaica Gleaner*, October 4, 1918.)

The Department of Agriculture, Commerce, and Labour, Cuba, issued a statement on August 10, announcing that the total sugar production of the crop of 1917-18 amounts to 3,408,878 tons. No decision has yet been arrived at as to the price to be allowed by the International Sugar Committee for Cuban sugars during the next season. (The *Cuba Review*, September 1918.)

Bulletin 328 of the Ohio Agricultural Experiment Station says that an acre of land devoted to the growing of corn, with an average yield of 35 bushels, will produce more than four times as much energy if used directly as a human food than if devoted to pork production in the growing of corn and clover in the most desirable proportion for economic pork production. An acre of wheat, with an average yield of 23 bushels, will furnish more than thirteen times as much energy as an acre devoted to beef production.

The *New York Journal of Commerce* is quoted in the *Port-of-Spain Gazette*, October 17, 1918, as stating that the importation of copra into the United States grew from 56,000,000 lb. in the fiscal year 1914 to 247,000,000 lb. in 1917. The imports are drawn from more than thirty countries and islands, the Philippine Islands supplying nearly one-half. The quantity of coco-nut oil imported has also grown rapidly from 74,000.000 lb. in 1914 to about 250,000,000 lb., the Philippines, as in the case of copra, contributing about one-half.

According to an address, on the fertilizer requirements on citrus trees, by H. J. Webber, Director of the Citrus Experiment Station, Riverside, California, delivered before the State Fruit Growers' Convention in 1914, it would seem that, in general, one of the factors of fundamental importance in citrus groves is to increase the amount of organic matter in the soil; and this can probably best be done by the regular use of a cover crop. This bears out the results of similar experiments undertaken on lime plots in some of these West Indian islands.

In Mauritius, according to *Colonial Reports*—Annual, No. 961, the fibre industry has been much hampered by lack of shipping facilities. However, with the satisfactory prices in the home markets, remunerative prices were obtained locally, and a certain quantity of good fibre turned out. Experiments with the new Corona decorticating machine were continued during the year. In the treatment of sisal leaves (Agave) it has proved to be a complete success, and further trials are contemplated for dealing with the local fibre plant (Furcraea).

The *Revista de Agricultura de Puerto Rico*, June 1918, contains on article by Mr. J. A. Stevenson, of the Insular Agricultural Station, drawing the attention of the planters in that island to Johnson grass as a particularly dangerous plant. The writer says that, unfortunately, by some means or other, this grass has obtained an entry into Porto Rico. It has been noticed in different situations in the surroundings of Rio Piedras, and is very common in the district of pine-apple cultivations, around Vega Baja. Planters are warned that it is very difficult to eradicate if once it has established itself, both on account of its perennial root system, and also on account of the number of seeds it produces.

The cultivation of onions, potatoes, and other vegetables for the United States markets still continues to be the chief agricultural industry of the Bermuda Islands. The principal market is New York. From figures given in *Colonial Reports*—Annual, No. 960, it appears that the quantity of potatoes exported from those islands in 1916 was 55,150 barrels, of a declared value of £58,414. The quantity of the onions exported during the same year was 147,000 crates, of the value of £33,446; while the quantity of other green vegetables exported also in 1916 was 252,233 crates, valued at £36,817. It is also to be noticed that there were exported during the same year 1,224 packages of the well-known Bermuda lily bulbs, valued at £1,305.

The International Institute of Agriculture has laid down a definite system for forming its estimates of crop condition. The fixed basis (100) was a definition formulated by the General Assembly of that Institute during the session of 1911. The number, 100, which is the basis of the system, is defined as representing a condition which, apart from any subsequent extraordinary occurrence, forecasts a yield for each unit of area equivalent to the last ten years. Every possible crop condition is stated in percentages of this fundamental basis. For example, if the average yield of a given cereal is 20 bushels, and the forecast is a yield of 21 bushels per acre, that will be represented by 105. But a forecast of 19 will be represented by 95. (*Documentary Leaflets* of the International Institute of Agriculture, Rome, August 15, 1918.)

THE JERUSALEM ARTICHOKE, A NEGLECTED SOURCE OF FOOD.

Under the above title, Professor T. D. A. Cockerell, of the University of Colorado, contributed an article to the *Scientific Monthly*, March 1918, to which we are indebted for much of the following.

The sun-flowers, genus Helianthus, are native only to the Western Hemisphere. About seventy valid species are recognized by botanists as occurring in America, north of Mexico, and between twenty and thirty species are found south of that line as far as Peru.

The species of Helianthus in the north-eastern United States and the adjacent parts of Canada develop edible tubers, so that there is a group of sun-flowers which possess no permanent aerial stems, but are reproduced annually both by seeds and by underground stems. Plants like these are ordinarily classed as perennials; they are, however, only perennial in the same sense as the potato is. Among these perennial sun-flowers is the Jerusalem artichoke (*Helianthus tuberosus*).

As in the case of the potato, the tubers of the Jerusalem artichoke arise from underground stems. The tubers of the potato are terminal, that is to say, produced at the extremity of the underground stem, whereas those of the Jerusalem artichoke are formed laterally also, or the underground stem itself may swell up and become a tuber. Consequently the Jerusalem artichoke bears a mass of tubers close to the main stem, although others may be more widely separated in the soil. Accordingly the tubers are very easy to harvest, and the space occupied by them is surprisingly small considering their quantity.

Helianthus tuberosus is not the only member of the genus which has been used as a source of edible tubers. *H. subtuberosus*, the so-called Indian potato of Michigan, has thick, fleshy, edible tubers. *H. doronicoides*, a native of Ohio, is used as food in Europe in the same manner as salsify.

As a source of food, *Helianthus tuberosus* was well known to the natives of America long before the advent of the white man. The tubers were much valued by the Indians on account of their hardiness and productiveness, and because they retained possession of the soil for many years. These tubers were mentioned by the French explorer Champlain in 1603, and brought to France by Lescarbot in 1612, who described them as being as big as small turnips, excellent to eat, with the taste of artichoke, but more agreeable, and multiplying in a wonderful way. Strange to say, though originally so much valued in the New World, the plant is now much more cultivated in the Old World.

The tubers appear to have been highly appreciated in Europe from the first. The plant was grown in the Farnese Gardens at Rome, and was distributed thence under the name of Girasole Articiocco, or sun-flower artichoke. Parkinson, the English botanist, noted in 1629 that they were then very commonly offered for sale in London.

The name artichoke is supposed to be derived from the Arabic name applied to a thistle-like plant, *Cynara Scolymus*, a native of the Old World. This is the true artichoke, and the edible part of that plant is the flower head, particularly the thickened involucral bracts. This and the Jerusalem artichoke have little in common, the plants being entirely different in appearance, and furnishing quite different parts as food. The name artichoke appears to have been given to *Helianthus tuberosus* solely on account of its somewhat similar flavour, while 'Jerusalem' is only an English corruption of the Italian 'Girasole,' which means sun-flower. Thus the designation 'Jerusalem artichoke' is as misleading as 'Guinea pig'. The French have a distinctive name, 'Topinambour', and the name in Spanish is 'Cotufa'. In view of the astonishing size of the crop and the value of the tubers as human food, it is singular that this plant is so largely neglected at present in the western world.

An experiment conducted by Professor Cockerell himself in Colorado gave a yield of 9·66 tons to the acre, and this has been exceeded in several other localities of the United States. In England, Messrs. Sutton & Sons have reported a yield of 18 stone of splendid tubers from 6 lb. planted. It must be remembered that the average yield of potatoes in the United States is said to be 84·5 bushels, though rising in some States to an average of over 150 bushels. Against this, the 'Encyclopedia Americana' states that the usual yield of Jerusalem artichokes is 200 to 500 bushels per acre, and that 1,000 bushels are sometimes obtained. The Jerusalem artichoke requirès less labour to plant and to cultivate than the potato.

As a tuber for general cultivation, the Jerusalem artichoke is not likely to become a successful competitor of the sweet potato and other edible tubers cultivated in the tropics, although it can be grown and give very large returns in these regions. It is, for instance, successfully grown in the Philippine Islands and in some of these West Indies.

Under the cultivation in Europe, especially in the hands of Vilmorin in France, and Sutton in England, several improved varieties have been put on the market, and doubtless such breeders in the future will still more improve the plants, and produce sorts adapted to special purposes and conditions.

The food value is about the same as that of the potato. As a food for stock, particularly hogs, it is stated that the Jerusalem artichoke is about equal to potatoes, and richer in protein than sweet potatoes. The dried leaves and stalks of the plant have been fed to sheep and cows and found about equal in nutritive value to good meadow hay. The young plants are also sometimes used as forage for cattle.

As a human food, the tubers can be used boiled as a vegetable, or as a salad, or in soup. In preparing them for the table, the irregularity of the tubers makes them hard to peel, and their peculiar taste is sometimes objected to at first, although it is easy to acquire a liking for them.

The cultivation of this plant, which is equally valuable as food for man and beast, might add very considerably to the food resources of these islands. The greatest obstacles seem to be prejudice and want of knowledge.

In Cuba, some interest is being taken in the cultivation of this plant. An article in the official organ of the Department of Agriculture, Cuba, July 1918, from the pen of Dr. Mario Calvino, draws the attention of Cuban planters to the desirable qualtities of the Jerusalem artichoke. The Doctor considers that the best way to grow this crop is to select healthy and vigorous small tubers, and to plant them in furrows, about 3 feet apart, the tubers being placed about 2 feet one from the other.

PLANT DISEASES.

A SCHEME OF CLASSIFICATION FOR PARASITIC PLANT DISEASES.

In a paper by F. L. Stevens (*Botanical Gazette*, Vol. 63, No. 4) the need, which will be generally admitted, for a classification of plant diseases, with reference to the nature of the parasitism involved, is pointed out, and the following useful scheme is suggested to this end:—

I. The parasite living in the sap or in cavities or parts devoid of living protoplasm:—

(a) Wilt disease, due to mechanical stoppage of vascular bundles by parasites, e.g. *B. solanacearum.*

(b) Diseases caused by disintegration of xylem structures, e.g. various wood rots, *Hydnum*, *Fomes*, etc.

II. The parasite for the most part of its life drawing its nutriment from host cells that are still living:—

(a) Endocellular parasites—the strictest type of parasite, e.g. *Synchytrium.*

(b) Diseases due to parasites which draw their nutriment from living cells by haustoria (endocellular haustorial parasitism,) e.g. *Peronospora, Cystopus.*

(c) Diseases affecting only live epidermal cells (epidermitis), e.g. *Erysiphales.*

(d) Diseases in which the parasite grows between the living host-cells; absorption is by the intercellular mycelium (intercellular mycosis), e.g. rusts.

(e) Diseases in which the host tissue is displaced or replaced by fungous masses (mycosclerosis), e.g. *Claviceps* and the smuts.

(f) The tumour-like diseases, e.g. *Pseudomonas tumefaciens.*

III. The parasite living within host-cells or tissues which have recently been killed or partly disorganized by it:—

(a) Diseases in which the dominant feature is death of the host-cells before they are actually invaded by the parasite (necrosis). According to the part involved we may recognize:—

(i) Cortical necrosis, in which the cortex chiefly is involved, e.g. *Sphaeropsis.*

(ii) Parenchymal necrosis, in which the parenchyma is affected, including the greater number of the soft roots, e.g. *Rhizopus Penicillium.*

(iii) Macular necrosis, in which necrosis is limited to spots chiefly occurring on leaves. Of this there are two types, according to whether there is abscission or not. Examples of the former are *Cylindrosporium* and *Marssonia*; of the latter, *Pseudopeziza* and *Septoria.*

THE PANAMA DISEASE OF BANANAS IN CUBA.

Dr. J. R. Johnston, Plant Pathologist, Department of Agriculture, Cuba contributes an article to the *Revista de Agricultura, Commercio y Trabajo* for August 1918, on the banana and its diseases, the greater portion of which is devoted to the Panama disease. This disease is caused by a fungus (*Fusarium cubense*), and has caused severe loss to growers of bananas in Cuba, especially in the case of two highly valued varieties known as 'Manzano' and 'Johnston'. Entire plantations of from 10,000 to 20,000 plants have been destroyed by the progress of the disease. Many planters have given up the cultivation of those two varieties, substituting for them another which goes by the name of 'Macho'.

The first symptoms of the disease are the yellowing and withering of the leaves. The bunch of fruit becomes twisted or aborted, or at least the fruits become small and dry. The stem of vigorous plants attacked splits longitudinally from the outside inwards. The suckers remain green until they too begin to show symptoms of the disease, and are unable to produce a healthy bunch of fruit. Successive generations of plants are in every case smaller and smaller.

Transverse sections of a diseased stem show that the fibro vascular tissues are affected with a yellow discoloration, changing to red and brown, which at length turns almost black. A transverse section of a diseased root-stock shows the central portion much discoloured, owing to the presence of the disease-producing organism which traverses it.

There are few healthy roots, and these are to be found chiefly towards the surface of the soil, taking their origin from the upper part of the root-stock. The only varieties of banana badly attacked in Cuba by this disease are the Manzano and the Johnston. On the other hand, there are several varieties which Dr. Johnston says may be considered for the present as immune. A similiar fungus however attacks these very varieties in Panama, and apparently the same fungus attacks other of these varieties in Porto Rico. The advice is given that in place of the Johnston banana in those districts where the disease occurs, one of the immune varieties should be planted.

Many investigations have been undertaken in the hope of discovering effective remedies against this disease. Chemical fertilizers have been applied to plants attacked, obtaining in some cases a vigorous growth but without conquering the disease.

Chemicals have been injected into the stem of the plant attacked without apparent results. Healthy plants from a district free of the disease have been brought into an infected district and they have contracted the disease. Diseased plants have been carried to spots free of the disease without any benefit resulting from such transplantations. Other crops have been cultivated for three years in fields where the disease existed, and when replanted with bananas the disease has broken out afresh. The control of this disease is certainly a great problem for the Cuban Department of Plant Pathology. Up to the present, only partial results in the line of preventive measures have been obtained by destroying the infected plants, disinfecting all instruments used in their cultivation, preventing the transport of earth or plants from infected fields, and forbidding the transport of plants from an infected region to another where the disease may not exist.

Diseased plants ought to be cut down. The stems should be cut in pieces and burnt with the foliage as completely as possible; the remainder ought to have a covering of quicklime. It is to be hoped that effectual remedial measures for combating this disease may soon be found.

NEW ZEALAND HEMP.

Under the above heading, an interesting article occurs in *The Times Trade Supplement*, October 1918. It would appear that this fibre might possibly succeed in other countries on swampy lands. The plant belongs to the Liliaceae, to which family the common aloes of the West Indies also belongs. The following is taken from the article referred to:—

British cordage manufacturers and American and Australian makers of binder twine for harvesters are fully conversant with New Zealand hemp (*Phormium tenax*), or flax, as it is called in this country. It is made from the fibrous structure or 'skeleton' of the leaf of the Phormium by a process of scraping the green pulpy coating of the leaf, and washing the remaining fibre in water, drying it in the open air, scutching and polishing it when it is fairly bleached, and then packing it in hanks, which are done up into bales, which usually go 5 bales to the ton.

The *Phormium tenax* is distributed throughout New Zealand from north to south, but it is most abundant in swamps in the Manawatu district, at the extreme south of the North Island, and here it is worked and attended to more as a crop. The swamps are all drained, and roaded for light tramways. Although the flax nominally grows wild, the swamps nevertheless are carefully looked after, and especially so for fires, and a very large sum of money in the aggregate is spent annually on their draining. This cultivation, if the term be permitted, has resulted in the production of 20 to 40 tons of green leaf per acre from swamps several feet under water all the year round, and considered worthless.

The leaves are from 5 to 8 feet long. They are sword-shaped, and grow in clumps. The clump or bush is cut down, but grows to full height four years after.

The *Phormium tenax* does not appear to suffer greatly from frosts. It is grown in England as an ornamental plant, and is being grown in St. Helena as a commercial undertaking, with what it is hoped will be satisfactory results to the people of that island.

The use of flax for rope, string, and twine by the Maoris was general from the time they arrived in New Zealand, and it was probably used for the same purposes by the people whom they displaced, and of whom but very few traces remain. Flax-weaving was brought to a fine art by the Maoris, who made ceremonial garments of the woven fibre, and sometimes introduced feathers into the fabric for ornamental effect. These cloaks are to day worn on great occasions, and are held in great respect by their owners, to whom they have come as heirlooms.

The modern use of the flax fibre is for making up into binder twine for harvesters; and for this purpose it is shipped to the United States (before the war through London). It is made into binder twine also in Australia and in New Zealand, and for this purpose is said to be superior to every other fibre.

The manufacture of the fibre is quite simple, and the principle is much the same as the Maori women observed. The green leaf is cut well down to the butt. Work in the swamps is hard in hot weather, but the ground is then quite dry under foot. There is no malaria, and there are no noxious insects or other pests. The leaves are bundled up, and carried by tramway to the mill. Here leaf by leaf it is fed into the stripper, which is a solid steel drum shaped wheel of about 12 inches in diameter, with zigzag ridges on its periphery. As this wheel revolves with great rapidity it scrapes the flax leaf or blade against a steel bar, and so frees it of its gummy green coating. The fibre is then drawn away and washed, and thence conveyed to drying paddocks, which are used for no other purpose. The fibre is hung along wires or allowed to bleach on the grass. These paddocks amount in the aggregate to an enormous acreage. When dry, and sufficiently bleached, the fibre is conveyed back to the mill for scutching and baling. It is afterwards graded by Government officers, and is sold on its grade note.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.I.C. has forwarded the following report on the London drug and spice market for the month of September, 1918:—

The general condition of trade in the London produce market during the month of September showed very little change from that contained in our report for the previous months, either in the bulk of produce brought forward or disposed of, or in the matter of prices paid or demanded; though the general tendency continues in an upward direction, and is likely to do so as long as the war continues. The following are the chief items affecting West Indian products:—

GINGER AND PIMENTO.

Ginger has been in very quiet demand throughout the month. At auction on the 15th, fair washed Cochin was quoted at 175*s.* and Japan at 140*s.* At the first spice auction on the 5th of the month, Pimento was quoted at from 6¾*d.* to 7*d.*—a price that was continued to the end of the month.

SARSAPARILLA.

This drug was in full supply at auction on the 26th of the month, being represented by 19 bales of grey Jamaica, 80 of native Jamaica, 26 of Lima-Jamaica, and 3 of Honduras. The grey Jamaica was all disposed at from 5*s.* 2*d.* to 5*s.* 7*d.* per lb. for fair and part mouldy; 40 bales out of the 80 offered of native Jamaica were disposed of at the following rates: for yellow to dull red 3*s.* per lb., and dull red to fair red 3*s.* 5*d.* to 3*s.* 6*d.* There were no buyers for either the Lima-Jamaica or the Honduras.

KOLA, CASSIA FISTULA, CITRIC ACID, AND TAMARINDS.

Kola was fully represented at the auction on the 26th of the month by 56 packages; 2 only, however, found buyers, 8*d.* per lb. being paid for ordinary mouldy from Antigua; the remainder—good bright West African quarters—were all bought in at 1*s.* 3*d.* per lb. Cassia Fistula was reported at auction on the 19th of the month as being scarce in consequence of the non-arrival of any consignment, which it was stated would probably fetch 150*s.* per cwt. when they did arrive. Citric acid has been the subject of some interest during the month in consequence, it was reported, of a considerable rise in the raw material due to its demand for export. Prices which at the early part of the month ranged from 3*s.* 7*d.* to 3*s.* 8*d.* per lb. had advanced at the close to 3*s.* 11*d.*, and in some cases, it was said, as much as 4*s.* 6*d.* had been paid. There has been but little demand for tamarinds. The price asked at the beginning of the month was 140*s.* per cwt., in bond.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, August 22.

ARROWROOT—No quotations.
BALATA—Venezuelan Block, no quotations; Sheet, no quotations.
BEESWAX—No quotations.
CACAO—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 4/6 to 5/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—9½*d.*
RUBBER—Para, fine hard, 3/0½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., October 4.

CACAO—Venezuelan, no quotations; Trinidad, no quotations.
COCO-NUT OIL—$1·46 per gallon.
COFFEE—Venezuelan, 15c. per lb.
COPRA—$7·25 per 100 lb.
DHAL—$11·50 to $12·00 per bag.
ONIONS—$10·00 per 100 lb.
PEAS, SPLIT—$8·00 per bag.
POTATOES—English, $4·00 per 100 lb.
RICE—Yellow, $13·00 to $13·25; White, $9·00 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., October 2

CACAO—Caracas, 13½c. to 14c.; Grenada, 13¾c.; Trinidad, 13¾c. to 14c.; Jamaica, 12c. to 12½c.
COCO NUTS—[illegible], $50·00; Trinidad $52·00 culls, $27·00 to $29·00 per M.
COFFEE—Jamaica, 10½c. to 10¾c. per lb.
GINGER—17c. to 22c. per lb.
GOAT SKINS—Importation prohibited.
GRAPE FRUIT—Jamaica, $4·50 to $5·50.
LIMES—Importation prohibited.
MACE—40c. to 45c. per lb.
NUTMEGS—31c. to 32c.,—unassorted.
ORANGES—$4·50.
PIMENTO—9¾c. to 10c. per lb.
SUGAR—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·055c. Molasses, 89°, 4·998c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 18.

ARROWROOT—$12·00 per 100 lb.
CACAO—$12·00 to $12·50 per 100 lb.
COCO-NUTS—$30·00 husked nuts.
HAY—$3·00.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
SUGAR—Dark Crystals, $5·50.

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OF THE
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Cotton Deterioration.

A TELEGRAM has been received by the Barbados Government from the Secretary of State for the Colonies directing attention to a serious mixing of low grade native cotton with fine quality of Sea Island. Mention is made of the fact that West Indian Sea Island cotton is intended for use in connexion with the war, and that great harm might be done if these inferior admixtures were spun and woven into cloth.

The telegram, as published, is as follows :—

'12th October. War Office states very serious mixing D.F. indigenous cotton has been found in lot Vauxhall ex "Colonial". Bales numbers 84, 90, 91 were quite useless for War Office purposes and consisted almost entirely of indigenous cotton, and there were traces of such indigenous cotton throughout whole lot. War Office cannot emphasize too strongly seriousness of admixture not only renders valueless cotton so mixed but may if undiscovered cause much damage to cloth. Immediate steps must be taken to prevent recurrence.'

This telegram, it will be seen, refers only to Barbados cotton. The only other complaint of a similar nature of which we have information was with regard to two bales of cotton shipped from St. Kitts, but since found to have been produced in the Dutch Colony of St. Martin.

On the publication of the telegram and the covering letter from His Excellency the Governor, several references to this affair were made in the local press, in some of which direct and deliberate fraud was suggested.

If this matter is regarded impartially, it will be seen that the probability that deliberate fraud had been practised in the mixing of low grade cotton with fine sorts is not very great.

In order for such fraudulent practice to be possible on a large scale, it would be necessary that considerable quantities of low grade cotton should be produced in the island.

This however can hardly be said to be the case in Barbados, where the bulk of the cotton grown is produced from Sea Island cotton seed. There is, however, a certain amount of cotton produced in Barbados which

is not of the Sea Island length and fineness. This is commonly known as 'native' cotton, plants of which may be seen growing about the houses of the labourers and small proprietors. It is of perennial type, and probably is descended from the cottons cultivated previous to the introduction of Sea Island; and is the cotton referred to in the telegram as indigenous. It is also a matter of record that the Barbados Department of Agriculture has experimented in the production of hybrid cottons, and has made extensive trials in the cultivation of the perennial types already mentioned.

The cotton produced from all these sources would hardly be sufficient in amount, even if it had all found its way into the one shipment against which the charge of mixing is made, to have attracted the attention which this lot of cotton did, and unless some other sources were known to be available from which native cotton could be obtained, it would be well to hold in abeyance any judgment to the effect that low grade cotton had been deliberately and wilfully mixed with the fine Sea Island type.

There can be no doubt, however, that in the shipment of cotton under consideration, there was a very considerable amount of lint which fell so far short of the standard as to lead the cotton experts who examined and valued the cotton on behalf of the Government to declare that mixing had taken place.

If the amount of low grade cotton produced in Barbados is not sufficient to account for such a mixture as that reported on, it would be well to consider another possible explanation of the situation.

Reference has already been made to perennial plants grown without cultivation about the small houses of the peasantry, and to the trials that have been made in the cultivation of hybrid and native cottons.

These all have an influence on the quality of the cotton produced in the island. Every plant of 'native' cotton which grows within reasonable distance of cultivations of Sea Island is a source of pollen which may cause cross-fertilization, and thus produce mixed seed in the next generation.

Hybrid cotton of the first generation or cross produces lint equal to that of its Sea Island parent, but the second and subsequent generations, and the crosses arising from the transfer of its pollen to Sea Island plants, result in the production of extremely divergent types which mostly yield very inferior lint.

It will be seen from this that the presence of native cotton and of hybrid strains is always likely to cause a deterioration in the Sea Island cotton as a result of cross-pollination, and if seed is planted from fields in which such crossing has taken place, the result will be the production of mixed cotton containing lint of very inferior quality.

There is further to be considered the fact that Sea Island cotton as at present grown consists, as in the case of most plants under cultivation, of numerous, slightly divergent strains. It is therefore necessary, in order that the most desirable of these should remain predominant, to practice constant seed selection.

Ever since the establishment of the Sea Island cotton industry in the West Indies, some sixteen years ago, the Imperial Department of Agriculture has advocated a system of strict and careful seed selection, together with the clearing out of plants in the field, which from their appearance indicate that the cotton they would produce would be different, and of inferior quality. Such plants are spoken of in general as 'rogues', and the process of clearing them out of the field as 'roguing'.

For some reason or other, cotton in Barbados appears to have been given much less attention in the matters of seed selection and roguing than is the case in the other cotton-growing islands. It is quite a common sight in certain districts of Barbados to see fields and small patches of cotton in which the plants represent in their general appearance and habit of growth many different types of cotton, that is to say, there is great divergence amongst the plants, and it is well known that this divergence is represented by variation in the lint produced. This applies principally to the cotton of small proprietors, but it is by no means entirely confined to them. Cotton fields on large estates are often seen to contain many rogues, and give evidence of very mixed seeds.

This condition prevailing in the cotton cultivation in Barbados was well recognized at the time of the Cotton Conference held by the Imperial Department of Agriculture in St. Kitt's in March 1916. Mr. Nowell, in discussing the question of the influence of pure strains on the prices obtained in the Liverpool market, pointed out that although Barbados cotton fields present obvious evidence of variety in type, and consequently their produce is far from being pure, it was still

receiving the same relative price as in former years, when the purity of the strains was equal to that of the strains grown in other islands. In the earlier years of the cotton industry in the West Indies, Barbados, St. Kitts, and St. Vincent ordinary were classed together, and usually sold for the same prices, these being slightly in advance of those paid for the Antigua, Montserrat, Nevis, and Anguilla cottons. (See *West Indian Bulletin*, Vol. XV, p. 273.)

Reference to the schedule issued by the Admiralty, when it was decided to take over all West Indian Sea Island cotton for the Imperial Government, will show that Barbados had lost its place in the matter of the price paid for its cotton lint, which was not then classed with St. Vincent and St. Kitts, but was put into a lower grade along with Montserrat, Antigua, and other islands. This point was discussed at a meeting of the Barbados Agricultural Society, where the following statement is reported to have been made by Sir F. J. Clarke, K.C.M.G., President of the Society:—

'Formerly the Barbados cotton fetched a price not much below that of St. Vincent cotton. That price was within the range of prices quoted for superfine cotton. After the Admiralty commandeered the cotton of this island a communication was received stating that, upon the advice of some gentlemen connected with the British Cotton Growing Association, Barbados cotton would not be within the range of prices quoted for superfine, but would be relegated to the lower grade of ordinary cotton, and consequently fetch a very much lower price.'

It would appear that the inferior quality of the cotton complained of by the Colonial Office may have resulted from the conditions outlined above, and if this be true, the suggestion of fraud in the matter would disappear.

Barbados is the only one of the British West Indies against the cotton industry of which this charge of mixing has been made. It is also the only island in which hybrid cotton has been grown on a commercial scale, and where the local Department of Agriculture has persisted with experiments in the hybridizing of cotton, and in the cultivation of low grade native cotton with the idea of improving it.

There are in Barbados, of course, estates on which good cotton is produced. Some of this is produced directly from seed imported from St. Kitts, which represents the closely bred strain of cotton maintained at a high level by persistent and consistent efforts on the part of the local Superintendent, under the direction of the Imperial Department of Agriculture. So good indeed is the present situation in St. Kitts, that Mr. F. R. Shepherd, the Agricultural Superintendent stated in a letter to the Imperial Commissioner recently, that 'one could ride round the island, and hardly see a rogue in any of the cotton fields.'

Experience has shown, and the instance under discussion illustrates, that the fine cotton industry can not safely be left to individual effort, but it must be the close concern of the Government of each island to provide through its Agricultural Department for an adequate supply of seed of good quality. Cotton growers will usually be found not only willing, but anxious to avail themselves of any source of carefully selected seed.

SOME OBSERVATIONS ON THE RELATION OF LINT LENGTH TO RAINFALL.

A paper on the above subject by Mr. R. E. Kelsick, Acting Chemical Assistant, St. Kitts, appears in the *West Indian Bulletin*, Vol. XVII, No. 2. The conclusions reached by Mr. Kelsick are of considerable interest; they are reproduced below:—

During the season 1917-18 it was observed that the lint from the selected plants of the different strains of Sea Island cotton grown at the Experiment Station, La Guérite, was much shorter than lint from the same strains grown during the previous season.

As it was considered improbable that the plants had deteriorated, an attempt has been made to discover some other factor which could account for the difference in lint length in 1916 and 1917.

It has been found in Egypt that there is a rise in lint length a few days after the plants have been irrigated. There seems to be no reason why the same should not hold good in these islands; that is, that cotton plants will only produce lint of maximum length when they have an ample supply of water at their disposal.

These results seem to indicate that in these islands the length to which cotton lint will attain in any season is dependent on the water-supply of the plant at the critical period of development.

To return to the length of lint of the different strains in 1917-18. The plots from which the plants were selected were planted on April 26, 1917, therefore over 60 per cent. of the flowers produced opened during the month of August; during this period there were only 3 inches of rain. On the other hand, in 1916-17 the rain which would have affected the developing bolls amounted to 11 inches—8 inches more than in 1917-18—consequently a great difference in the length of the lint is seen.

In view of these facts, it appears that great caution should be exercised in making comparisons of the length of cotton lint grown in different seasons, or in different islands the rainfall of which is in no way comparable.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. The following comprised plant distribution during the month of October: limes, 5,450; budded citrus, 48; nutmegs, 26; grafted mangoes, 11; miscellaneous, 33; Nicaragua shade tree cuttings, 10,000; horse beans, 65 lb.; Tephrosia seeds, 3 lb., vegetable seeds sold, 180 packets; black-eye peas, 84 lb. Mr. J. Jones, the Curator, states that the crop from the lime experiment station during the month aggregated 77 barrels, making a total to date of 694 barrels of limes. The local market price for lime products remained unchanged. Shipments during the month were satisfactory, averaging 46,170 gallons of concentrated juice, and 132,700 gallons of raw juice. The cacao crop is late, and prospects appear to be poor. The rainfall recorded for the month was 6·67 inches.

GRENADA. During the month of October the following plants and seeds were distributed: limes, 1,500; coco-nuts, 192; budded oranges, 26; grafted mangoes, 15; ornamental plants, 15; Sea Island cotton seed, 11 lb.; horse beans, 219 lb.; red kidney beans; 9 lb.; large papaw seeds, 50 packets; various seeds, 22 packets; cuttings, 4 Regarding staple crops, Mr. Moore states that the picking of cacao had begun, promising a good crop in some sections though backward in others. The nutmeg crop is spoken of as exceptionally good, and the lime crop as good. Potatoes are being extensively planted; yams are fair to good, according to cultivation; a second crop of corn is being sown. Sea Island and Marie Galante cotton, where properly cultivated, are looking promising. Cotton stainers are making their appearance. Mr. W. Nowell, Mycologist on the Staff of the Imperial Department of Agriculture, visited the island from October 19 to 28, investigating a disease of coco-nuts. The rainfall registered at Richmond Hill during the month was 11·76 inches.

ST. LUCIA. Plant distribution during the month of October included: limes, 3,575; budded oranges, 20; coffee (Robusta), 158; decorative and ornamental plants, 16; cassava cuttings, 550; vegetable seeds, 75 packets. Concerning staple crops, Mr. Brooks states that cacao was being reaped, and promised well; the lime crop was still coming in; while sugar-canes were growing well and gave promise of a good crop. Shipments made from the Government Lime Juice Factory during the month comprised 3,680 gallons of concentrated lime juice and 1,584 lb. of distilled lime oil to England, and 500 lb. of distilled lime oil to New York. The rainfall recorded during the month at the Botanic Gardens, Castries, was 13·46 inches; at the Agricultural and Botanic Station, Choiseul, the total precipitation was 7·89 inches.

MONTSERRAT. The Curator, Mr. W. Robson, writes to say that the weather during the month of October was excellent for crops. Plant distribution included: lime plants, 2,500; bay plants, 700; corn, 184 ears; sweet potato cuttings, 1,690; sapodilla, 19; cowpeas, 31 lb.; sword beans, 21 lb.; climbing Lima beans, 9 lb. The Chateau bay plot yielded 6,000 lb. of bay leaves to the end of October. There is promise of a good second crop of cotton, the chief danger now apprehended being an excessive rainfall during the next two months. Of the 1918 cotton crop, 588 bales have been delivered to the Government: it now appears probable that the island will make an average crop. The remainder of the 1917 crop (416 bales) was shipped during the month. The destruction of old cotton plants has been started on areas severely infested with leaf-blister mite, or where the rains have caused the plants to make excessive second growth. In one or two districts cotton stainers are present in great numbers. Experiments have been started to destroy silk-cotton trees by means of poisons; the destruction of Mahoe trees by felling has also been commenced. The rainfall recorded at the Grove Station during the month was 7·13 inches, chiefly in the early part of the month; the total rainfall for the year to date is 45·07 inches.

ST. KITTS. In his notes of interest for the month of October, the Agricultural Superintendent, Mr. F. R. Shepherd, states that there has been much improvement in the crops in the Experiment Stations in consequence of recent rains. Plant distribution included 65 cypre (*Cordia gerascanthus*) for planting at Government House. The condition of the Botanic Gardens has much improved since the rains, and annuals have been planted out. The cane crop throughout the island has also considerably improved during the month, and in the northern district a good average return is anticipated. In the Basseterre or Valley district, the ratoons are very poor in consequence of the long drought and the absence of artificial manures, and the returns are not expected to exceed the crop of last year. On some estates where plants were available, the planting of the new cane crop has begun. The cotton crop in the northern district has been gathered, and the plants are being turned under as the land is being prepared for cane. The yield has been above the average for many years in this district owing to the suitable weather. In the lower lands cotton picking is in full swing, and the new growth on the plants consequent on the rains is remarkable. The cotton worm has been very violent in its attacks, and large quantities of poison had to be used owing to the frequent showers. Cotton stainers are also very prevalent, and the recent Ordinance passed for the destruction of their native food-plants is very much needed. All the old cotton crop has now been shipped, together with 46 bales of the new crop. The rainfall for the month was 5·48 inches; for the year to date, 34·78 inches.

NEVIS. Mr. W. I. Howell, the Agricultural Instructor, writes to say that the plots in the Experiment Station were all in good order. Plant distribution during October included 17,000 sweet potato cuttings. The sugar-cane crop throughout the island has very much improved since the rains, and the crop, though very late, may not be as bad as was anticipated. Preparation for next season's crop is in progress, and there will be a fair increase in the acreage put under cane. The cotton crop throughout the island is fairly good, and reaping is in progress. Good returns are being obtained on many estates, but it is feared that the heavy rains will cause boll-shedding, and that the second picking will not be as good as was expected. Cotton worms are very troublesome throughout the island, and damage is being done to many fields. In many cases a sufficient quantity of Paris green was not secured by the planters, and in consequence, the worms were not dealt with promptly. Cotton stainers are also very abundant, and a fair amount of stained cotton and diseased bolls has occurred. Provision crops, on the whole, are doing well; the planting of sweet potatoes is still in progress. The rainfall for the month was 6·36 inches; for the year to date, 40·72 inches.

ANTIGUA. According to items of interest forwarded by Mr. T. Jackson, plant distribution during the month of October comprised: eucalyptus, 2,788; coco-nuts, 161; decorative plants, 47; miscellaneous, 4; sugar-cane cuttings, 200; sweet potato cuttings, 41,600; cassava cuttings, 700; cotton seed, 157 lb.; rice seed, 23 lb.; vegetable seeds, 2 packets. The cane crop, on account of the last two months' seasonable weather, has materially improved. Although the canes are low, they now have a healthy growth, and

should good weather be experienced during the next two or three months, it is possible that a fair crop will be made. The cotton crop, on the whole, is giving rather better returns than last year: this applies to the early planted cotton. Very severe attacks of cotton caterpillars have occurred during the month, and difficulty in keeping these in check on account of showers, and the weak mixture of Paris green and lime used (1:20) has been experienced. Some fields have been damaged considerably by the pest. The Granary was opened during the month, and 33,218 lb. of cob corn was dried. The mill for making meal is now in working order. It appears from experimental trial that 200 lb. of meal per hour can be made. Good rains were experienced throughout the island during the month. The rainfall at the Botanic Station was 4·28 inches; for the year to date, the record is 31·31 inches.

ST. VINCENT. During the month of October, 600 cane cuttings of good varieties were distributed. In some districts, Mr. Sands states, the rainfall was too heavy for early planted cotton, and the lower bolls more particularly were attacked by Phytophthora rot. The reaping of arrowroot was started. The corn crop was smaller than that of last season: about 800 cwt. of corn was purchased at the Granary. Some shipments went forward to Barbados, and one shipment of about 15 tons to the United Kingdom. The sale of corn meal at the Granary was continued. The payment on account, and bonus for corn purchases of the 1917-18 crop equalled 3·19c. per lb. of 'wet' grain.

The Agricultural Superintendent visited several estates in connexion with cotton investigations. The relatively few stainers seen had been collected. Bush bugs were also few in number, and eggs collected were extensively parasitized. In early planted cotton on one estate, external boll disease had damaged the lower bolls.

The Imperial Commissioner of Agriculture, Sir Francis Watts, arrived at St. Vincent on October 9, and left on October 28. Besides visiting the Botanic Gardens, Experiment Station, and the Government Ginnery and Granary, and inspecting and advising on the work of these institutions, the Commissioner visited the Windward and Leeward Districts, and discussed with planters questions connected with the coco-nut, cotton, and sugar industries. Before a meeting of the Agricultural and Commercial Society held on October 26 under the presidency of His Honour the Administrator, Sir Francis read a paper entitled 'Concerning Cotton in St. Vincent, and the Steps that must be taken to Safeguard the Industry.'

The weather during the month was rather too wet at times for crops. The rainfall recorded at the Botanic Station was 13·29 inches; at the Experiment Station, 10·05.

AGRICULTURE IN BARBADOS.

So far, the rainfall for November averaged 3 inches, the distribution of which has been most satisfactory. There could be no complaint of the character of the weather which has prevailed during this month.

Planters have been able to proceed almost uninterruptedly with the preparation of their fields, while up to the present there has been no anxiety about the healthy and vigorous development of the crops for the next reaping season.

Men, women, and children are busily engaged with every form of work, and one seldom passes an estate yard without seeing carts carrying manure either to be put into the fields or to be spread on pens which are being forced for distribution next month.

We would refer, as we have in past reports, to the fact than in some districts a large amount of green material is left on the hillsides and in gullies. This would considerably assist in raising pens during the earlier months. We have heard in some instances that the labour is not sufficient for the collection of this material; in others, that it is not the custom to have it done. Money spent on such work is a good investment, and we know of estates which years ago used to green manure some fields with excellent results.

It is a serious loss to the soil of the island not to turn into it, either through heaps of compost or through green-manuring, every scrap of material that is available for manurial purposes. We are sure that the sheep manure bill will be thus reduced, while the benefit to the soil would be considerable.

Potatoes have been less plentiful during the past fortnight. The rush to get them out of the fields to be planted in canes is drawing to a close, and the supply will soon be normal only. We observe that the Government has prohibited the exportation of sweet potatoes after to-day, 16th instant.

The old cane crop, as far as the plant canes are concerned, leaves nothing to be desired. Everywhere it is thought that the results will be in advance of this year's. The fields of B.6450 have developed very much recently, and are continuing to grow rapidly.

The cotton crop, though small, is generally healthy. Bolls are, in many instances, well developed, while the trees still continue to flower abundantly.

The yam crop on the estates shows much promise. It has had just the weather it required. This vegetable is being sold at 4c. per lb. in Bridgetown and the neighbouring parishes, but in the north of the island we learn that it may be purchased at the rate of 4 or 5 lb. for 10c. The peasants would do very much better with their yam crop if they would manure their plots. Their yams are ready for the market before the estates reap, and a good return would be very profitable. (The Barbados *Agricultural Reporter*, November 16, 1918.)

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., the Imperial Commissioner of Agriculture for the West Indies, returned to Barbados to-day after an official visit to Antigua.

Mr. H. A. Ballou, M.Sc., Entomologist on the Staff of the Imperial Department of Agriculture, will be visiting Grenada early in December on matters connected with his work. Mr. Ballou will probably be absent from Barbados for about a fortnight.

It is stated in 'Leaflet No. 2.' Department of Agriculture, Mauritius, that there appears to be a belief current in many quarters in that colony, that the cultivation of maize exercises a peculiarly exhausting effect on the soil, and that as a result, the production of the crop is likely to be fraught with undesirable consequences in the future. This is a mistaken notion. Maize is by no means an excessively exhausting crop; the toll of plant food removed from the soil as the result of its cultivation is indeed distinc ly less than is the case with other crops which are extensively planted.

MOSQUITO CONTROL.

In the publications of the Imperial Department of Agriculture for the West Indies, attention has from time to time been drawn to the importance of mosquito control in tropical countries, but, as was pointed out in the editorial of the previous number of the *Agricultural News*, there is need for more sustained and instructed work in this direction. The *West India Committee Circular*, September 19, 1918, points out that Dr. Sambon, who visited these islands some years ago, thinks they are very backward in the measures taken to control mosquitoes of all kinds.

A lecture by Dr. W. Dwight Pierce, the leader of the class for the study of the Entomology of Disease, Hygiene, and Sanitation—the formation of which was noticed in the *Agricultural News*, July 27, 1918—has been received at the Head Office of this Department. The lecture is reproduced below. At the end will be found a brief list of recent publications on the subject.

Probably more money and more concentrated effort have been devoted to mosquito control throughout the world than to the control of any other disease-bearing insects. We may discuss the essential elements of mosquito control topically.

PREVENTION OF MOSQUITO BREEDING.

By far the most important measures to be taken are those which prevent the breeding of mosquitoes. In this class of measures we therefore have to deal in some manner with water. If general mosquito control is sought, it is not essential to ascertain the species breeding, but when large communities or armies are to be protected against disease-bearing mosquitoes, time may not permit of general mosquito control, but may necessitate particular attention to the haunts of the disease bearers.

SCOUTING.

The preliminary measures to be taken, therefore, are the organization and training of scouting parties designated primarily to search out the breeding haunts of these species, and to report them to the details or squads designated for control work. The scouts must be trained entomologists, skilled in the knowledge of mosquito haunts. They must examine the water in all receptacles in and around buildings, and in discarded vessels. They must seek out all puddles, hoof prints, wagon ruts, tree holes, ditches, and streams, and carefully examine these. A chart should be kept showing the location of all water, and this can be marked in various ways to indicate the species present. Coloured pin markers on a wall chart are very serviceable. A field chart would have to be marked otherwise.

LEVELLING AND FILLING WATER HOLES.

Squads of men may be detailed to look after the levelling of ground where water is apt to gather and remain, and to fill up small puddles, pools, hoof marks, ruts, etc., which serve no useful purpose, and where drainage is inadvisable. Holes in trees should be be filled up with cement. Stumps which hold water should be grubbed out, and the stump holes filled. In rocky streams, pot holes in the rocks often breed many mosquitoes. If possible, the rock should be grooved, or removed, or the holes may be filled with cement.

DITCHING AND CLEARING STREAMS AND SWAMPS.

Other details may be designated to clear stream beds, and drain lowlands. Spring lands, bogs, and swamps furnish an abundance of mosquitoes, and are the first places to receive the attention of the ditching squads. Ditches must be constructed to carry off standing water. These should be laid out by an engineer. The ditches must have straight banks, and even bed, and must be kept free of vegetation. Sometimes it is necessary to spray the vegetation along the ditches with oil, and burn it. All burrow pits and puddles caused by grading roads and railways should be connected up by a ditching system, or filled. Flowing streams usually have trees along their sides. Under such trees water is often trapped to form a quiet undisturbed place for mosquito larvae. Trees must not grow on the edge of the bank. Tree roots must be removed from the stream. Any kind of vegetation growing in the bed of a stream favours mosquito breeding, as it affords some protection against natural enemies, and prevents adequate artificial control. The stream bed must be clear of vegetation. The banks must be straightened, and constructed without overhanging ledges. There should be no obstruction to the free flow of the stream. If it meanders, a new and straight course ought to be constructed, and the old course filled. Springs which furnish good water should be boxed and protected. Le Prince and Orenstein very ably describe in their book, the methods of clearing streams and propagation areas in jungles in the tropics.

CLEARING OF WEED-FILLED BAYS AND LAKES.

Large bodies of water in which dense growths of grass and weeds occur furnish great problems in many camps; and in tropical countries, especially where feasible, it is often desirable to furnish the mosquito squad with two motor boats, and with submarine saws or other implements for cutting and removing vegetation. If this cut vegetation remains, it aggravates the situation. Large lily leaves, which when alive furnish no place for breeding, will often, when dry, form cups of water, in which mosquitoes breed prolifically.

DRAINAGE.

The construction of drainage systems should preferably be done by a sanitary engineer who understands the mosquito phase of the problem. The main ditches should be constructed first, and the laterals added later. Sometimes, where weed growth is rapid, it is desirable to have a double, parallel, series of ditches, one only operating at a time during heavy rains, with the idea that the idle ditch can be cleaned and shaped up. It is essential that the floor level of the ditch affords no opportunities for puddles to form after the greater part of the water has passed off. In permanent ditching it is sometimes feasible and advisable to line the ditch with concrete, or at least to line the bottom. Weep holes should be made at sufficient intervals to carry into the drain water which gathers on the outside of it. Branch ditches should enter the main ditch at an acute angle, or on a curve. At the junction of bridges there should be a splash wall to confine the water within the ditch. Pot holes formed in dirt ditches should be filled up after rains with gravel or stone and tamped hard (see Le Prince and Orenstein, pp. 137-44).

In certain soils where seepage water out-crops abundantly on hillsides, it is sometimes practicable to install an intercepting tile drainage system. The tiles are laid at right-angles to the flow of the seepage at the highest seepage water level, with a space of one-eighth to a quarter inch between joints. The grade of the trench bottom must be true. Tiles must not be located on soft mud where they may sink.

The outlet should be well above the ground surface (see Le Prince and Orenstein, pp. 130-66).

In some localities, when ditches become matted with algae and other matter, and contain mosquito larvae, it is possible to construct water gates to permit temporary impounding of water, which will enable the ditch squads to flush thoroughly the ditch below the gate, and to remove all mosquito larvae and algae.

LARVICIDES.

The ditching, draining, and cleaning of water ways ensure a regular flow, and carry off all surplus water, and thus reduce but do not prevent mosquito breeding. It is necessary to use some additional means of control; and for this purpose various larvicides have been applied, but principally kerosene, and crude oils of paraffin and of asphaltum base, as well as creosote oils.

The question of the effect of oils on mosquito larvae is most thoroughly discussed by Freeborn and Atsatt, who find that the toxicity of the petroleum oils as mosquito larvicides increases with an increase in volatility, the more volatile oils producing the more marked lethal effects. The volatile constituents of the oils contain the principles that produce the primary lethal effects. The lethal effects are produced by the penetration of the tracheal tissue by the volatile gases of the oils. In the heaviest and least volatile oils, having a boiling point greater than 250°C., this action may be supplemental, or apparently secondary to the effect of actual contact of the oil with the body tissue, or perhaps to mechanical means such as suffocation or plugging of the tracheae. They found that oils which killed very quickly did so by means of the volatile gases, whereas in case of oils with slow effectiveness, the mechanical suffocation may be the cause of death.

These authors have set down a number of requirements for a good larvicide:—

1. It shall have a high toxic power, so that a small quantity may suffice for a large volume of water.
2. It shall kill rapidly, in order that subsequent dilution and weakening by rain have as light effect as possible.
3. It must be uniform in its toxic power, and capable of standardization.
4. It should mix freely with brackish and alkaline waters.
5. It must be harmless to man and domestic animals, when in the dilution necessary for larvicidal action.
6. It shall not be susceptible to rapid deterioration.
7. It must be inexpensive.

They did not find any substance which fulfilled all these conditions, but found that a soap, now known as the Panama larvicide, met most of their requirements.

This was made of the following ingredients:—

Resin	150 to 200 lb.
Soda	30 ,,
Carbolic acid (sp. gr. 0 97)	150 gallons.

This makes liquid soap which freely emulsifies with fresh water. The carbolic acid must have at least 15 per cent. of phenols, and no greater specific gravity than 0·97.

This larvicide is manufactured as follows: Heat the carbolic acid in a steel tank with steam coil. When steaming hot, add the resin, and continuously stir the mixture by means of a paddle agitator until complete solution is effected. Dissolve the caustic soda in 6 gallons of water, and add to the mixture. Heat and stir for five minutes. Draw a sample and pour into water. If it emulsifies, the process is complete, and the product may be put into shipping drums which must be tightly closed.

(To be continued.)

MANURIAL EXPERIMENTS WITH SEA ISLAND COTTON IN ST. VINCENT IN 1917-18.

Mr. S. C. Harland, Assistant for Cotton Research on the Staff of the Imperial Department of Agriculture for the West Indies, has contributed a paper to the recently issued number of the *West Indian Bulletin* (Vol. XVII, No. 2), in which he continues his record of manurial experiments with Sea Island cotton in St. Vincent, the first part of which is to be found in the *West Indian Bulletin*, Vol. XVI, No. 3.

Mr. Harland seems to have reached some important conclusions as a result of his experiments; the summary of these is reproduced below:—

The manurial experiments with Sea Island cotton at the St. Vincent Experiment Station have been studied by means of flowering and bolling records for two successive seasons, in which weather conditions were widely different.

All the manured plots showed increases over the unmanured. The increase was greatest in the plot to which potash was applied; but a large gain was also shown by the complete manure plots. The remarkable fact was brought out that the addition of phosphate to the potash tended to lower the yield.

Manures had no effect whatever on the time of maturing of the crop. Manures had no effect on the precentage of bolls to flowers. The yield obtained when two plants per hole were left was considerably greater than when there was only one. The need for further experiments on the spacing of Sea Island cotton is emphasized. Spacing had no effect on the percentage of bolls to flowers.

It has been shown clearly that, under the conditions under which the experiments were carried out, there is a striking uniformity in the time at which flowering begins, reaches its maximum, and declines to zero. If the sowing date be known, we can state with certainty when most flowers and bolls will be produced, and when the crop will be finished. We cannot predict what the size of the crop will be further than by stating its probable maximum. The size of the crop depends on weather conditions, and on the incidence of fungoid disease. Thus, in the West Indies, or indeed in any country where cotton depends for its water-supply on rainfall and not on irrigation, the value of its flowering records is very much less than in Egypt. The Egyptian bolling curve is of less amplitude than the flowering curve, chiefly through shedding. The percentage of shedding is said to be practically constant at 40 per cent. In non-irrigated countries the bolling curve represents the bolls left after shedding and disease have taken their toll, and we have seen that the percentage of bolls to flowers fluctuates greatly from season to season. For manurial and spacing experiments in the West Indies, it is probably sufficient to take bolling records only, at weekly intervals. I do not think that the practical planter need concern himself with either flowering or bolling curves. For the comparison of different varieties in regard to yielding capacity, both flowering and bolling records are almost essential. It is certain that considerable differences exist in Sea Island cotton in respect of the liability to shed bolls. These differences could be brought out adequately, only by a careful study of the flowering and bolling records.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* / Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

CLERICAL STAFF.

Chief Clerk	A. G. Howell.
Clerical Assistants	L. A. Corbin. / P. Taylor.* / K. R. C. Foster.
Typist	Miss B. Robinson.
Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

**Seconded for Military Service.*
†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

The editorial in this number deals with the important question of deterioration of Sea Island cotton.

Insect Notes, on page 378, give a summary of the occurrence of insect pests observed in the smaller British West Indian islands during the year 1917.

The appearance of a new fungus disease of coffee in Surinam is noted under Plant Diseases on page 382.

The first part of a lecture on mosquito control by a distinguished American entomologist, is reproduced on page 374.

The 'West Indian Bulletin', Vol. XVII, No. 2.

The first paper in this number of the *West Indian Bulletin*, which has recently been issued, is a continuation by Mr. S. C. Harland of the record of his manurial experiments with Sea Island cotton in St. Vincent. The first article on these experiments, conducted at the St. Vincent Experiment Station during the period 1912-17, appeared in the *West Indian Bulletin*, Vol. XVI, No. 3. The present article deals with the experiments carried through in 1917-18. The interesting summary of the results obtained, and the conclusions arrived at by the author are reproduced on another page of this number of the *Agricultural News*.

The second paper, a short one, by Mr. R. E. Kelsick, deals with the relation of lint length in cotton to rainfall. Mr. Kelsick's conclusions as a result of his observations will also be found on another page of this number of the *Agricultural News*.

The third paper is the Report on the prevalence of some pests and diseases in the West Indies during 1917. This is compiled by the Entomologist and Mycologist attached to this Department. A review of the first part of this report will be found under Insect Notes in the present number of this Journal.

The fourth paper relates to the shrinkage of soils, the larger portion of which has been reproduced from a paper by Dr. H. A. Tempany, in the *Journal of Agricultural Science*, Vol. VIII, Part 3.

It will thus be seen that the present number of the *West Indian Bulletin*, although somewhat shorter than usual, contains matter of distinct interest.

The Pink Boll Worm at Barbados.

A schooner recently arrived at Barbados from Para, Brazil, with a mixed cargo consisting of cotton seed, pollard, dry cassava, and cassava farine.

The cotton seed was destined for oil mills in Barbados, and the entire cargo was to be landed at that port, and a portion of it forwarded later on to England.

According to the authority vested in him by the Order of November 21, 1912, the Superintendent of Agriculture, Barbados, prohibited the landing of the cargo, because the cotton seed came from a country where a serious pest of cotton (the pink boll worm) was known to occur. The cotton seed and the other cargo were regarded as things which might introduce the pest into the island. The cargo did not only come from a country in which a dangerous pest is known to exist, but it was actually infested, as evidenced by the capture in the holds of the schooner of several moths of the pink boll worm (*Gelechia gossypiella*). A small portion of the cargo other than cotton seed was landed, but this was afterwards ordered to be reshipped.

The final action in the matter indicates that the entire cargo will be transhipped in the bay to some vessel which will convey it to England.

The arrival of a vessel at a port in the West Indies carrying a cargo of cotton seed infested by the

pink boll worm is a most serious affair, and even if permission is refused to land the cargo, there is still a menace to the cotton industry. The distance from the anchorage to the shore, and to growing cotton crops is probably not more than the moths are capable of covering in their flight in such ports as Barbados, St. Vincent, Montserrat, and St. Kitts. It is true that the anchorage is usually to leeward, and that ordinarily the flight ashore of the moths would mean flight against the wind, but during the whole of the rainy season a southerly or westerly breeze is of frequent occurrence.

Cotton seed, seed-cotton, and even ginned cotton from a country in which the pink boll worm is known to occur, should not be imported into any cotton-growing country. Any packages of cargo in the hold, in which seed infested by pink boll worm is contained, are liable to be the means of carrying ashore the pupae of this insect, and from these the moths may emerge and make their way to growing cotton.

The question has been raised in Barbados as to whether the legislation which provides for meeting such an event as the present is of sufficient power. The danger to be apprehended in any colony where cotton is grown, and cotton seed is imported for planting or for oil production is so great that most careful attention should be given to the details of existing legislation; and if this is not adequate to make it possible to deal satisfactorily with any such condition in the event of its arising, then special attention should be given to enacting adequate legislation.

Experiments in Tea Cultivation in Ceylon.

The results of experiments in the various manures on tea plants for 1914, at the Peradeniya Experiment Station, are recorded in *Bulletin No. 37*, of the Department of Agriculture, Ceylon, July 1918, from which the following items of general interest are reproduced:—

Some of the plots not under permanent green manures began to show marked deterioration in the wood and frames of the bushes, although yields were fairly maintained.

Plots under rubber also fell off rapidly in yield owing to the shade of the latter, and the tea was cut out in August 1916. In September 1916, two plots were each treated with 1,000 lb. of well-burned and slaked lime, the lime being broadcasted upon every row and lightly forked in. Three plots each had 500 lb. similarly applied.

The permanent effect of cattle manure in one plot has also been most marked, the last application having been made in March 1908, when 30 tons per acre were applied. The total actual yield from this plot since 1906 is 8,987 lb., or if calculated to 2,722 bushes per acre, 11,379 lb., the area only containing 2,158 bushes. Taking bi-yearly periods since 1906, the cattle manure being applied in 1908, a practically continuous rise in yield is shown to the present time.

Agricultural Tractors in Trinidad.

From an editorial note in the *Proceedings of the Agricultural Society of Trinidad and Tobago* for September 1918, it would appear that the use of tractors for agricultural purposes is extending in Trinidad. Reference is made to the recent importation of six Breaman garden tractors, which are designed for work in vegetable gardens. This tractor, it is stated, will cultivate any crop planted in rows from 12 inches to 3 feet apart. It is easily operated and controlled, and can be turned round in a small space. Attachments of garden hoes, cultivators, discs, etc., are provided for, and these can be adjusted for use on rows of different widths. It is claimed that the Breaman tractor costs no more than a first class young mule, and that it can do the work of two mules.

Besides these garden tractors it is noticed that a Caterpillar tractor is at work on one of the large coco-nut estates with very satisfactory results, the work performed per day being more in quantity, more effective, and cheaper than that hitherto accomplished by teams of draught oxen.

Many sugar plantations on the island are making extensive use of mechanical implements in their cultivation.

Effect of the Introduction of Exotic Animals and Plants on Native Flora.

In an article on Hawaiian botany in the *Hawaiian Forester and Agriculturist*, October 1918, attention is drawn to the effect of alien agencies on indigenous vegetation. In his three visits, 1892-94, the celebrated explorer, Vancouver, not only introduced many European seeds and plants into the Hawaiian islands, but also landed the first goats and cattle ever seen there, and the cattle were placed under taboo by King Kamehameha for a period of ten years. The wild goats and cattle multiplied with almost incredible rapidity, and before many years had passed, they had much damaged the Hawaiian forests. The pronounced depletion of the forests in all regions to which these herbivorous animals had access, the extinction of numerous plant species, and the conspicuous curtailment of the ranges of many others may all be traced to the destructive influences of wild goats and cattle running at large through the mountains and waste lands.

Similarly, thousands of acres formerly occupied by the native vegetation is now in the possession of weeds cosmopolitan throughout the tropics, which have displaced the less vigorous indigenous forms. There is probably no region that manifests with greater clearness than Hawaii the rapid action and far-reaching influences of alien organisms upon an insular fauna and flora. The innumerable introductions—both intentional and unintentional—of plants and animals from many other regions have entirely changed the phyto-geography of all Hawaii save the comparatively inaccessible mountain fastnesses.

To a less extent the above description of the effects of cosmopolitan weeds may be noticed also in the West Indian islands

INSECT NOTES.

INSECT PESTS IN THE WEST INDIES IN 1917.

The latest number of the *West Indian Bulletin* (Vol. XVII, No. 2) contains, at page 83, a report on the Prevalence of Some Pests and Diseases in the West Indies in 1917.

This has been compiled from the reports of the Agricultural Officers in the several islands of the Windward and Leeward Islands groups, and is the ninth in the series, the last previous one, that for 1916, having appeared in the *West Indian Bulletin*, Vol. XVI, p. 309.

The object of the present article is to review the portion of the report dealing with insect pests, which was compiled by Dr. J. C. Hutson, B.A., Ph.D., Acting Entomologist on the Staff of the Imperial Department of Agriculture.

SUGAR-CANE.

The pests of sugar-cane were the same as in previous years, and occurred to about the same extent.

The moth borer (*Diatraea saccharalis*) was reported as present in cane fields generally. Severe attacks were noted in certain localities in St. Vincent and St. Lucia; in the latter island these occurred more particularly in the naturally drained lands.

The weevil borer (*Metamasius sericeus*) was of general distribution in St. Lucia and Antigua: in the latter island it is stated that this pest is probably doing more damage than is realized at the present time. No definite records are given of the injury caused by the root borers, Diaprepes and Exophthalmus. The adult beetles were present in those islands where sugar-cane is grown, but no mention is made of the presence of the grubs attacking the underground portions of the cane.

In St. Kitts large numbers of the adults of the insect *Exophthalmus esuriens* were found in the hearts of the young canes in the middle of the year, and on the experiment plots at La Guérite quantities were collected and destroyed.

The hard back grubs (*Lachnosterna* sp.) were common on heavy lands in the central part of Antigua, and it is stated that they are probably responsible for a considerable amount of damage to the cane crop.

White ants, or termites, were reported only from Antigua, where they occurred on limestone land, but were not regarded as serious pests. In St. Kitts, where attention was first attracted to the attacks of white ants on sugar-cane on certain estates, they were not reported in 1917, and they seem to be dying out.

The cane fly (*Stenocranus* [Delphax] *saccharivorus*) was not recorded from any of the islands.

In Grenada the froghopper (*Tomaspis saccharina*) did not spread to cause any extension of the infested area, and the degree of infestation was less severe than in 1916.

In St. Lucia mealy-bugs were recorded as being common in cane fields, grasshoppers were of general distribution and caused slight injuries, while a small beetle is recorded as doing a fair amount of damage to the blades of young cane plants.

The young shoots of the cane were attacked by the grass-looper (*Remigia repanda*) in Dominica, and grasshoppers caused a considerable amount of damage to young canes in St. Kitts, and a small amount in Nevis.

COTTON.

The cotton worm (*Alabama argillacea*) is reported to have been less severe in Montserrat than for several years past, while in Antigua severe attacks of this insect were experienced in October and November when showers of rain washed off the insecticides applied, and, in consequence, a considerable amount of damage was done, especially to peasant-grown cotton. In the Virgin Islands unusually severe attacks occurred late in the season.

The corn ear worm (*Laphygma frugiperda*) and the boll worm (*Heliothis armiger*), were of general occurrence, but appear to have caused no damage of consequence. Cotton stainers, which are now known to be associated with the occurrence of internal boll disease, have assumed a new importance. In St. Vincent, where active control measures were in force in 1916-17, cotton stainers occurred locally only where control measures were defective. In Bequia their attacks were severe.

In Montserrat they probably did less damage than usual, while in St. Kitts the cotton stainer was more in evidence during the 1917 season than perhaps ever before. They appeared about November, and yielded to no endeavours to reduce their numbers. For the first time flights of these insects from field to field were noticed.

In Nevis it was estimated that cotton stainers caused serious damage by infecting cotton with internal boll disease.

The bush bugs (*Vezara viridula* and others) have been studied in St. Vincent principally, and the relation of these insects to cotton in that island has formed the subject of articles in the *West Indian Bulletin* and *Agricultural News*.

The green bug has been found capable of causing bolls to be attacked by internal boll disease. Scale insects on cotton are not generally considered serious pests, since their attacks become severe late in the season, usually about the time the crop is off and the old plants about to be destroyed. In 1917 scale insects were reported as being severe in the leeward districts where certain infested trees occurred near cotton fields.

The flower-bud maggot (*Contarinia gossypii*) was recorded at the Experiment Station, Tortola, where it occurred in the previous season.

Leaf-blister mite (*Eriophyes gossypii*) was rather more abundant than usual in St. Vincent, Antigua, and Nevis; in all cases this was due to carelessness in destroying old cotton, or to planting cotton in the immediate neighbourhood of old infested plants. In St. Kitts this pest attacked cotton with great severity, and in one district caused some loss.

In Antigua isolated attacks of aphis were recorded. In Nevis the Lachnopus weevil occurred in localities on young cotton, but caused little damage. Grasshoppers and the common field cricket attacked young cotton in one district in Nevis.

CACAO.

The cacao thrips (*Heliothrips rubrocinctus*) was reported as being severe in two islands only. In St. Lucia it was said to be locally severe, especially on lowlands; and in Grenada the attack was said to be milder than in

1916, and that there was only slight extension of the area on which the attacks occurred. Some control had been effected on small areas by spraying with Bordeaux mixture.

In the previous number of the *Agricultural News* the Insect Notes related to cacao thrips. Figures given in that issue show that the cacao crops of 1916 and 1917, as seen by the amounts of cacao exported, were the largest ever recorded for Grenada. This was in face of the attacks of thrips in 1916, which were reported to be most severe.

The cacao beetle (*Steirastoma depressum*) was reported during the year from the western coast of Grenada, where it was locally severe.

Mealy-bugs were reported as occurring in Grenada, St. Lucia, and Dominica. The insect referred to was probably *Pseudococcus nipae*.

Cacao trees were damaged to a slight extent by non-tunnelling termites in Grenada.

LIMES AND OTHER CITRUS CROPS.

In Grenada, St. Vincent, and St. Lucia, scale insects on limes were reported to be generally distributed and locally severe. *Coccus viridis* was reported as being severe on seedlings in nurseries in St. Lucia. In Dominica scale insects were reported as usually present on poor cultivations and on cultivations in the course of being established.

The bark borer (*Leptostylus praemorsus*) was recorded in Grenada and St. Lucia.

The records as to the occurrence of the Diaprepes and Exophthalmus weevils in the case of cacao, as with sugar-cane, refer only to the adults; the grubs live in the soil, and are very difficult to observe, and in consequence they are but little remarked. It is reported that on one estate in Antigua, 100,000 adults of *Exophthalmus esuriens* were estimated to have been killed in June.

SWEET POTATO.

The sweet potato pests would appear to have been of small consequence during 1917. The 'jacobs' or 'scarabee' (*Euscepes batatae*) occurred in most of the islands. In Antigua this pest commonly occurs in potatoes grown by peasants, and not as a rule in potatoes grown on estates. The leaf-eating caterpillars appear to have caused but little injury except at Virgin Gorda, where *Protoparce cingulata* attacked sweet potato vines rather badly.

INDIAN CORN.

The pests of Indian corn are of interest because of the efforts that have been made to increase the production of this cereal as a war-time measure.

The caterpillars *Heliothis armiger* and *Laphygma frugiperda* were present. In Antigua a fair amount of damage was reported, while in St. Kitts the corn ear worm caused much loss during the year, and the situation was made more serious by the extremely dry weather. The use of Paris green and corn meal was successful in controlling the attacks on the plant, but later, the corn was attacked in the ear.

In certain localities in Antigua Indian corn was somewhat damaged by attacks of hard back grubs.

The moth borer of sugar-cane was very troublesome as a pest of Indian corn in St. Vincent. Grain weevils are reported as having been generally distributed, attacking the corn while ripening in the field, and when stored.

COCO-NUTS.

The usual pests of coco-nuts were reported as occurring, but they appear to have been of very little importance during the year.

GROUND NUTS

Ground nuts were attacked by plant bugs in St. Vincent.

ONIONS.

Onions were attacked by caterpillars, but these were not recorded as being severe, except in the Virgin Islands. Thrips were reported from Antigua and Nevis, and in Antigua the hard back grubs attacked onions so severely as to make it impossible to grow this crop in certain districts

GREEN DRESSING (BEANS AND PEAS).

The principal pests of green-dressing crops are leaf-eating caterpillars and the bush bugs (*Nezara viridula* and others). The leaf-eating caterpillars were not much in evidence in 1917.

The bush bugs are of special importance, since in addition to the direct damage which they do by feeding on these plants, some of them are responsible for infecting the fruits with the fungi of internal boll disease, and of carrying it from these plants to the cotton. During 1917 these insects were reported from Grenada; as doing much damage by carrying fungi of internal boll disease in St. Vincent; of being abundant and doing a fair amount of damage on the crop at the Experiment Station at Nevis; while in the Virgin Islands they usually appear early in the year, and are frequently destructive.

In St. Vincent a weevil which attacks the young seeds of cowpeas, bonavist, and pigeon peas has done great damage in many parts of the island, and a certain amount of damage has resulted from attacks of the small moth (*Ballovia cistipennis*) on the pods and seeds.

PLANTAINS AND BANANAS.

The black weevil borer (*Cosmopolites sordidus*) occurs in St. Lucia, Dominica, and Antigua. Although it has long been recognized as attacking these plants, it has not attracted much attention until lately. Reference may be made to articles in the *West Indian Bulletin* and the *Agricultural News* as to the status of this insect.

In the report under review it is not recorded from Antigua; the record of the occurrence of this insect in that island is of recent date.

In St. Lucia the injury is reported as being particularly apparent during the dry season. In Dominica it is a serious obstacle to the cultivation of plantains. Bananas are attacked to a much less extent.

In St. Lucia the black hard back borer (*Tomarus bituberculatus*) attacks banana and plantain bulbs, and is a serious pest of tannias, dasheens, and eddoes.

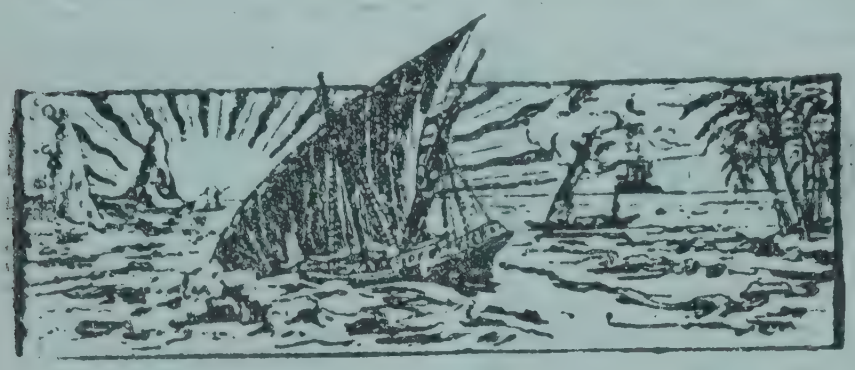
Under the heading 'Miscellaneous Insects and Pests otherwise unprovided for', reference is made to the attacks of boring insects in the twigs of mahogany in St. Lucia and Antigua. This was probably the larva of the small moth, *Hypsipyla grandella*.

The large longicorn beetle (*Batocera rubus*), which has been introduced into the Virgin Islands in recent years, continues to be plentiful.

In Dominica the mango maggot, the larva of the fruit fly (*Anastrepha* sp.), was unusually abundant. Wood-boring beetles, ambrosia beetles, were troublesome in their attacks on hogsheads and puncheons for shipping lime juice. The slug or 'palute' (*Veronicella occidentalis*) was not so much in evidence as a pest of provision crops as in 1915.

NATURAL ENEMIES OF INJURIOUS INSECTS

The predaceous thrips (*Franklinothrips vespiformis*) was fairly well distributed in Grenada on cacao trees infested with the cacao thrips. The hymenopterous egg-parasites of bush bugs were abundant in certain districts in St. Vincent. In the Virgin Islands the Jack Spaniards have disappeared since the hurricane of 1916, and the unusually severe infestation of cotton worm is believed to be in part due to the absence of this useful predaceous insect. H.A.B.



GLEANINGS.

In the rich valley of the Sacramento River in California, it has been found that rice can be produced very readily, and in heavy crops of fine grain. It is planted at the rate of 85 to 90 lb. per acre for the first crop, and up to 130 lb. in subsequent years. For the first and second crops 40 sacks of 100 lb. each is regarded as the minimum successful yield, and crops of about 50 sacks on a whole plantation are not rare. (*Tropical Life*, September 1918.)

Not only is the production of camphor declining markedly in Japan, but considerably less menthol and mint oil is being produced. The Japanese farmers are turning their attention to peas, beans, and other esculents, which they find more profitable to grow than mint. Estimates of this year's crop indicate that the yield will be about one-third short of the average. (The *Perfumery and Essential Oil Record*, September 1918.)

The *International Sugar Journal*, October 1918, has a short note on the working of three sugar factories on the Zambesi River in Portuguese East Africa. Each estate harvests annually some 140,000 tons of cane, mostly of the Uba variety, which gives up to 90 tons per acre in plant canes, sixteen and eighteen months old. First ratoons give 30 to 35 tons; other ratoons go down to 15 tons per acre. The fibre in the Uba cane ranges from 16 to 20 per cent.

According to the *Farm Journal* for November 1918—a journal published in Philadelphia—the United States produced before the war more swine than any other nation in the world, Germany being second. The number of hogs in the United States before the war was estimated at nearly 60 millions, and in Germany about 25 millions. At present it is estimated that in the United States the pig population has increased to more than 70 millions, while in Germany it has diminished to about 12 millions.

In the *Proceedings of the Agricultural Society of Trinidad and Tobago*, September 1918, in an article on the banana, it is stated that the local Department of Agriculture has done good service in popularizing the use of green bananas as a diluent for wheat flour in bread. Many recipes have been recommended, but the following seems to be worth a trial on account of its simplicity: Boil green bananas in salted water, and when thoroughly cooked, pour off the water, mash the bananas, and to 30 per cent. of that mash add 70 per cent. of flour dough; this will produce a bread of very palatable quality.

The Sugar Equalization Board in the United States has had to fix the prices for the coming crop. The Cuban 1918-19 crop price has been the most important one under consideration. Cuba has been holding out for an increase of 1c. per lb. over the present figure of 4·60c., on the ground that even that increase will do little more than cover the rise in cost of production. The data supplied by the Cuban manufacturers have been too convincing to be ignored, for the Board has finally fixed on the price of 5·50c., only 0·10c. below the Cuban demand. (The *International Sugar Journal*, October 1918.)

In an article on the development of the ground nut industry in British India, *The Board of Trade Journal*, September 12, 1918, states that there should be absolutely no waste with proper organization of the industry. Besides the value of the oil as human food, the ground nut cake is valuable as a cattle food, and even the plant itself makes excellent fodder and hay for cattle. The paper-like husk containing the seed may be used for stuffing mattresses and cushions, and possibly also as a source of cellulose for paper-making. If these husks are burnt as fuel, the ash, being rich in phosphates, makes a good manure, as also does the thin red coating to the kernel.

Arrangements have been made, says the *Tropical Agriculturist*, July 1918, between the College of Hawaii and the Sugar Planters' Experiment Station, for the institution of a four-years' course in Sugar Technology. This includes general science as applied to agriculture, the agriculture of the suga-rcane under Hawaiian conditions, the chemistry of sugar, and the chemistry and engineering of sugar manufactures. Arrangements have been made for practical training in chemistry and engineering in factories while at work. The proposals follow closely those which have been successful at Audubon Park, Louisiana, and at the School of Agriculture, Mauritius.

The eighteenth annual balance sheet of the Coastal Farmers' Co-operative Society, Ltd., for the sale of farm and dairy produce, the head office of which is at Sydney, New South Wales, affords a wonderful example of progress and benefit as the result of co operation among farmers. The sales of the first year of its operation (1901) were £71,855, yielding a dividend upon paid up capital of £45, and a bonus returned to consignors of £1,262. The total sales for the year ended March 31, 1918, of dairy and farm produce were £2,348,324, the dividend upon paid up capital at the rate of 7 per cent. was £2,170, and the bonus returned to consignors was £22,768.

In an article on Canada and the West Indies in the *Financier and Bullionist*, October 20, 1918, it is stated that even under present unsatisfactory commercial treaties and lack of sufficient direct transportation facilities, the exports from Canada to the West Indies have more than doubled during the last three years, and the imports have increased from about $8,000,000 to $21,000,000. If the Canadian consumption of tropical products increases in the same ratio, in ten years they would amount to more than $50,000,000. Canadians are bound to realize more and more how much the world depends upon tropical produce, and that the great rivalry of the future will be for control of the tropics.

UNITED STATES SUGAR IMPORTS AND EXPORTS.

The United States reports of Foreign Commerce in the United States for the seven months ending July 31, says the *Louisiana Planter*, October 26, 1918, show that during those seven months 1,927,516 short tons of sugar were imported into the United States and were valued at $179,589,491. These figures stand as against the figures for the previous year of importations of 1,936,518 tons, practically the same quantity, valued at nearly 15 million dollars less, or at $164,980,375. For the year ending July 31, 1916, the total imports reached 2,062,694 short tons, valued at $164,529,038, slightly more sugar than the succeeding year, and about $450,000 less in total value. Considerable quantities of these sugars were taken to the United States, and there refined and then exported.

In the exportation of these sugars the Department of Commerce includes them among the exports of domestic products, whereas probably not one pound of the sugar exported was of domestic production. The sugar refiner takes the sugar already produced and of high grade, generally about 96-test, and by washing and filtering it eliminates the brown colour and whitens the sugar, a manipulation that bears little or no relation to the real manufacture of the sugar. Any way, this vagary of the government in its commercial reports is misleading in its character.

For the seven months ending July 31 only 49,676 tons of sugar were exported. The limited quantity stands as against 307,538 tons during the same period last year, and 547,339 tons the year before. The emergency calls in Europe for sugar led to the landing of many of their foreign sugars in New York to undergo the process of refining, but in the meantime Great Britain has so improved her own resources in refining as to have caused the immense drop or decline in our exports of refined sugars.

The fixed values placed upon sugars by the Food Control Board have resulted in a degree of uniformity in the import prices of sugar that, while no longer a novelty, is a phase of the sugar industry never before seen.

The exports of refined sugar for the seven months ending July 31 were valued at $6,413,256, and were almost exactly 50,000 short tons in quantity. Over 24,000 short tons of these sugars, valued at over 3 millions of dollars, went to France; 8,000 short tons, valued at a little over a million dollars, went to Belgium, and the United Kingdom got 7,000 short tons valued at about $900,000; the rest of the American exports went to various smaller countries.

Apropos of the foregoing, Mr. Herbert Hoover, Food Administrator, has recently issued, through the United States Food Admistration Office in New Orleans, a prospectus of the food conservation necessary for the Federal Union for the year 1919. As affecting the sugar question, Mr. Hoover's views of sugar supply are of great interest. Sugar shipment from the United States for the three years before the war averaged 618,000 tons. For the year ending July 1, 1918, 1,520,000 tons were shipped, and Mr. Hoover now calculates that for the year ending July 1, 1919, there must be shipped 1,850,000 tons of sugar—an increase of 330,000 tons over the previous year. While as compared with foodstuffs, the increase of which is estimated as slightly over 50 per cent., the percentage of increase in the exports of sugar (slightly under 20 per cent.) does not look very large, still it is quite significant; for it is computed that it would practically take all the loose sugar lying in Cuba and anywhere in the Western World, and also the surplus lying in the Far East, unless there happens to be a very successful season in the Western World and the crops turn out much larger than usual, and larger than can fairly be expected.

An additional point taken into consideration is that this increased quantity of sugar demanded for Europe is a continued and convincing appreciation of the wonderful value of sugar as food.

PRICES OF SUGAR.

In a pamphlet entitled 'Questions and Answers concerning Sugar', issued by the Bureau of Statistics, Washington, there are many interesting facts brought forward which perhaps are not always well understood even in sugar growing countries.

With regard to the price of sugar, it is remarkable that until the War occasioned an abnormal rise in price, sugar is the one staple food product the price of which has not shown a material increase for the decade 1900-1910. In 1900 the price of sugar per lb. in New York was 5·32c. and it had fallen in 1910 to 4·97c. The increase in prices of other staple foods in the New York market for the same period ranged from 14·4 per cent. for potatoes and beans, to 89·8 per cent. for salt pork. The average increase, as shown by the Bureau of Labour, in the price of thirty-three leading staple foods was 45·3 per cent. while, on the other hand, the price of sugar decreased 7 per cent.

The price of raw sugar in the world is regulated by the law of supply and demand. The quantity of stocks on hand is always relatively small, and both an actual and an anticipated material increase or decrease in the world's production violently affects the price. For instance, owing to serious drought in Western Europe in 1911, which resulted in a decreased production of 1,500,000 tons of beet sugar, the price of raw sugar in Hamburg advanced 50 per cent. within ninety days from the time the drought was first reported. Again, owing to increased world production of both beet and cane sugar, and the consequent increase in sugar stocks, the average price of sugar in 1913 had reached its lowest point. Because of the war, however, the beet-sugar crop of Europe in 1914-15 was 665,000 tons less than the preceding crop, and the production of the next year was still further reduced by $2\frac{1}{4}$ million tons, a decrease which was not made up by the increased production of cane sugar. Great Britain, which had been purchasing 60 per cent. of her sugar supply from Germany and Australia, immediately began buying raw sugar in tropical islands, especially in Cuba, which had formerly marketed the bulk of its output in the United States. With two competing purchasers instead of one who had known that the Cuban producer must come to him sooner or later, the world's price of raw sugar rapidly increased, causing a similar rise in the price of refined. Great Britain was unable to purchase a sufficient quantity of raw sugar, and then commenced purchasing refined sugar made from Cuban raw sugar in New York. Other European nations also entered the United States market, which raised the price of raw sugar delivered at New York from 3·50c. per lb. in 1913 to 5·78c. per lb. in 1915, while the average price of refined sugar, which was 4·27c. per lb. in 1913, advanced to 6·86c. in 1916.

Sugar may be said to be a hand-to-mouth product. It is also to be remembered that the present high price paid by the consumer for sugar, is also due to the rise in the rates of freight, and the difficulties of marine transport.

PLANT DISEASES.

A NEW COFFEE DISEASE IN SURINAM.

Dr. Gerald Stahel, in *Med. van het Depart. van den Landbouw in Suriname*, No. 13, describes an affection of Liberian coffee under the name of the Sclerotium Disease. It was briefly noticed by Kuyper, in *Bulletin 31* of the same Department, as the Coremium disease, but since that time has assumed a greater importance.

On mature leaves the fungus produces brown, dead spots, with distinctly marked concentric rings. In continuously humid weather these may expand over the entire leaf. The underside of the spots bears white, spiny outgrowths, 2-4 mm. long, which do not bear spores, but are easily broken off and carried by the wind to other coffee trees, on which they serve to originate new infestations.

The ripening fruits are similarly attacked, with the production of concentric-zoned spots, and when dead they are entirely covered with the white spines. On both leaves and berries while still on the tree, there may be developed (in damp weather) brown or orange-brown sclerotia, and these occur in profusion on the fallen berries. In very damp weather a feathery mycelium is produced on the material lying on the ground.

Where a cluster of fruit is involved as a whole, the fungus may invade the cushion, and thus inhibit further production.

The disease ceases to extend with the onset of the dry season. It is supposed that it is again renewed from the sclerotia, but in what manner remains as yet unknown. Spore-formation of any kind has not been observed, but from the presence of clamp-connexions in the hyphae, the fungus is believed to be a Basidiomycete.

Apparently good results have followed the use of Bordeaux mixture against the disease. The disease is at present confined to plantations along the Surinam River, and is especially severe on an estate on the upper river. It has not been detected, in the field, on Robusta, Uganda, or Surinam coffee, though infections were secured by artificial means. Abeokuta and Excelsa are very susceptible.

W. N.

ALCOHOL PRODUCTION.

From time to time, and very much more so recently, suggested additional sources of alcohol have been discussed and experimented with, and up to the present the most promising new raw materials for fermentation spirit are apparently wood waste, which is used on a small commercial scale in America (*Agricultural News*, Vol. XVII, No. 429, p. 313), and certain tropical plants rich in carbohydrates. True synthetic alcohol is also being made in Switzerland from calcium carbide *via* acetylene. The *Perfumery and Essential Oil Record*, October 1918, now discusses the subject from the standpoint of increasing the production of fermentation spirit. After stating the essentials necessary for making carbide alcohol, namely, cheap power such as is provided by water-falls, and ample supplies of coal and limestone, attention is directed to what is considered to be really of more immediate importance, that is, the breaking of fresh ground for fermentation spirit. It is mentioned that the chief sources of the European spirit have hitherto been three. Great Britain has depended on grain, and Germany on potatoes, while in certain wine-growing countries such as Italy, years of abundant vintage have yielded alcohol at a low rate from surplus wine All these, however, trench on the food supply, and what is now sought is primarily material which is not wanted for human consumption. The Imperial Government is taking the matter up seriously, and a committee has been appointed to investigate the available sources of supply (with particular reference to manufacture from materials other than those which can be used for food purposes), the method and cost of such manufacture, and the manner in which alcohol should be used for power purposes. The whole question, it is pointed out, is one of prime moment to the perfumery trade.

Sir T. E. Thorpe, writing to *The Times* of October 16 concerning the appointment of the Committee referred to above, remarks that, no doubt, the main object of the enquiry will be to determine methods of producing cheap alcohol for use as fuel, particularly motor fuel. He recalls the fact that the question had been already dealt with by a Departmental Committee. It was admittedly surrounded with difficulties—economical, fiscal, and mechanical—some of which have possibly been overcome. As for the fiscal objections, these, Sir Edward states, will have to be met, if it is satisfactorily established that alcohol can be economically used for power purposes. Under the changed conditions due to the War, and owing to the great increase in knowledge and experience, it is undoubtedly time that the problem should be officially reconsidered. Many projects have been published from time to time for the production of ordinary alcohol from non-alimentary materials, and there is a large amount of patent literature on the subject. The greater number of these suggestions may be classified under two heads. They depend either on the production of fermentable substances capable of forming ethyl alcohol, or on the synthetic formation of compounds which may be made to yield this alcohol by purely chemical means.

Sir Edward goes on to say that in the first class is the production of alcohol from marine algae. It has been shown that such seaweeds as *Laminaria digitata*, *L. stenophylla*, and *L. saccharina*, the common wracks or tangle, and the various *Fuci*, the black and bladder wracks, all of which are abundant on the British shores, and some of which were formerly of importance as sources of alkali and iodine, may be made to yield considerable quantities of alcohol by appropriate treatment. Thus it has been stated that 100 lb. of red wrack, dried to a moisture content of 10 per cent., when heated for a short time with weak sulphuric acid and the acidity still further reduced after cooling, may be fermented with brewers' yeast, and is then capable of yielding about 6 litres of alcohol on distillation. It is alleged that under industrial conditions this amount may be increased.

If these statements can be verified, continued Sir Edward Thorpe, we have in our seaweeds a ready and cheap source of alcohol, and the possibility of employment to a poor population whose means of livelihood were greatly impoverished by the loss to them of the kelp industry. The mode of collection and preliminary treatment of seaweed for use in the chemical arts were largely worked out by the late Mr. E. C. C. Stanford many years ago, and are applicable to the present suggested employment. In addition, we have the experience of America; the collection and utilization of the giant weeds of the Pacific coast is now an established industry.

ALCOHOL FUEL COMMITTEE.

The Field, October 19, 1918, draws attention to the appointment by the Government of a new committee, under the chairmanship of Sir Boverton Redwood, delegated to investigate the possibilities of producing alcohol in Great Britain from other than articles of human food for the purpose of fuel, and, no doubt, other commercial purposes.

The question of providing some alternative fuel to petrol for motor use is so pressing that much of the article in *The Field* is reproduced below.

There is no objection to the use of alcohol as motor fuel beyond a necessity to modify engine design to meet its characteristics, or an alternative loss of power as compared with petrol or benzol, and a difficulty in starting the engine—which can be obviated by doing that on petrol. By the admixture of a form of ether a fuel capable of easy starting, and said to possess much of the practical characteristics of benzol is being used in South Africa, under the name Natalite. If the accounts rendered of that fuel be borne out by experience, it would appear that the fuel problem is solved for most of our colonies.

Unfortunately in Great Britain there are no considerable supplies of alcohol producing material outside foodstuffs such as potatoes, but there is much which, in the ordinary course of events, is not utilized for any purpose, and so that would be all to the good. It is not likely that in Great Britain sound potatoes could be used for alcohol production, for the simple reason that it is an extravagant use of food material of which it is not probable that too much will be produced for some years to come. Prior to the war pure alcohol reached this country from Germany at a price of 10*d.* a gallon—a figure which would not permit the British farmer to raise potatoes with profit: and yet it seems essential that fuel alcohol must not cost very much more if it is to be a standard fuel. Possibly it is for that reason that Sir Boverton Redwood's committee is limited in its terms of reference to other than articles of human food. Even if and when that committee in its report advises a practical programme, there will remain many obstacles to surmount before alcohol or Natalite, or any other similar blend, can be sold in the same way as petrol and benzol. But an altered attitude on the part of the Inland Revenue authorities is to be hoped for, which will entirely change the situation as it has been governed in the past. It is not too much to say that had those authorities been other than antagonistic, alcohol fuel would have been placed on the market years ago, even though it could only have been an alternative to petrol at about 2*s.* per gallon. No doubt there were serious fiscal difficulties in the way, but there was no sympathy wasted on the desire for an alternative fuel, and nothing could be done by private enterprise or endeavour. The chief value of this committee will come in the information it will bring regarding the value of alcohol as a motor fuel.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets [illegible] of October, 1918:—

The satisfactory condition of the war news that has prevailed through the month of October has had its influence, though slight, in the produce markets, sometimes with the tendency towards the lowering of prices, and at other times in the opposite direction. It is, however, too early to expect any real change in either direction, or indeed in any other; consequently buyers are still content to purchase only in sufficient quantities to meet the immediate requirements. The following are the principal details affecting West Indian products.

PIMENTO, GINGER, AND MACE.

Pimento has gradually advanced in price during the month, due apparently to the fact that its importation can be effected now only under licence. In the early part of the month 7½*d.* per lb. was the price asked, but at auction on the 17th, sales were effected at 7¼*d.* per lb., and at the last auction on the 31st of the month, fair quality sold at from 6¾*d.*, to 7*d.* Ginger was in good supply at auction on the 17th of the month, consisting of 120 barrels and 154 bags of Japanese, 40 bags of washed rough Cochin, and 25 bags of limed Japanese. All these were brought in at prices varying from 185*s.* to 190*s.* per cwt. for good bold Japanese. Limed Japanese was held at 135*s.*, and the rough washed Cochin at 170*s.* At auction on the 24th of the month, ginger was again in good supply, and a small amount of business was done, Jamaica fetching from 165*s.* to 180*s.* per cwt. for middling to good, washed Cochin 170*s.*, and Calicut 160*s.* Some Sierra Leone was also disposed of at from 135*s.* to 137*s.* 6*d.* per cwt. At auction on the 17th of the month, mace was represented by 32 bags of Bombay, and 124 packages of Singapore. Of the first, 3*s.* 11*d.* per lb. was paid for wormy and broken, and for the second, 3*s.* 10*d.* to 4*s.* for reddish.

CITRIC ACID, ARROWROOT, SARSAPARILLA, KOLA, CASSIA FISTULA.

Citric acid has been in good demand throughout the month, starting at 4*s.* 6*d.* per lb. at the beginning, and 4*s.* 10½*d.* to 5*s.* at the close. Arrowroot has been in good demand at advanced rates, fair manufacturing St. Vincent being quoted at 1*s.* 7*d.* per lb. At auction on the 24th of the month, sarsaparilla was in good supply, consisting of 43 packages of grey Jamaica, 86 of native Jamaica, 39 of Lima-Jamaica, and 6 of Honduras; 23 bales of the grey Jamaica were disposed of at 5*s.* to 5*s.* 2*d.* per lb. for fair to good fibrous, and 4*s.* 11*d.* for sea-damaged. Only 1 bale of the native Jamaica was disposed of at 2*s.* per lb. for sea-damaged. The Lima-Jamaica and Honduras found no buyers. At this same auction 34 packages of kola were offered, and disposed of, good bright West Indian halves fetching 8*d.* to 8¾*d.* per lb.; fair and partly mouldy fetched 7¾*d.* to 8*d.*, and small, part mouldy, 6*d.* to 7¼*d.* per lb. At this auction 8 packages of Cassia Fistula—all that were offered—were sold at an advance of from 32*s.* 6*d.* to 35*s.* per cwt. on previous rates, wormy Dominican realizing as much as 157*s.* to 160*s.* per cwt.

Kapok, the fibre surrounding the seeds of the silk-cotton tree (*Eriodendron anfractuosum*), is being imported into the United States in increasingly large quantities, principally from Java. The consumption of kapok fibre in the United States amounted to 8,472,830 lb. in 1917, an increase of 45·7 per cent on the amount used in 1916. (*The Board of Trade Journal*, September 19, 1918.)

MARKET REPORTS.

London.—The West India Committee Circular, August 22.

Arrowroot—No quotations.
Balata—Venezuelan Block, no quotations; Sheet, no quotations.
Beeswax—No quotations.
Cacao—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
Coffee—Jamaica, no quotations.
Copra—£46.
Fruit—No quotations.
Ginger—Jamaica, no quotations.
Honey—Jamaica, no quotations.
Lime Juice—Raw, 4/6 to 5/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6.
Logwood—No quotations.
Mace—No quotations.
Nutmegs—No quotations.
Pimento—9½*d.*
Rubber—Para, fine hard, 3/0½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., October 4.

Cacao—Venezuelan, no quotations; Trinidad, no quotations.
Coco-nut Oil—$1·46 per gallon.
Coffee—Venezuelan, 15c. per ℔.
Copra—$7·25 per 100 ℔.
Dhal—$11·50 to $12·00 per bag.
Onions—$10·00 per 100 ℔.
Peas, Split—$8·00 per bag.
Potatoes—English, $4·00 per 100 ℔.
Rice—Yellow, $13·00 to $13·25; White, $9·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros & Co., November, 14.

Cacao—Caracas, 14¾c. to 15c.; Grenada, 14¼c. to 14¾c.; Trinidad, 14½c. to 15c.; Jamaica, 12¾c.
Coco-nuts—Jamaica selects, $51·00; Trinidad culls, $28·00 to $29·00 per M.
Coffee—Jamaica, 14c. to 17c. per ℔.
Ginger—17c. to 20c. per ℔.
Goat Skins—Importation prohibited.
Grape Fruit—Jamaica, $2·50 to $4·00.
Limes—Nominal.
Mace—43c. to 45c. per ℔.
Nutmegs—30c.
Oranges—$2·50 to $3·50.
Pimento—9c. to 9¼c. per ℔.
Sugar—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·155c Molasses, 89°, 5·052c. all duty paid.

Barbados.—Messrs. T. S. Garraway & Co., October 18.

Arrowroot—$12·00 per 100 ℔.
Cacao—$12·00 to $12·50 per 100 ℔.
Coco-nuts—$30·00 husked nuts.
Hay—$3·00.
Molasses—No quotations.
Onions—No quotations.
Peas, Split—No quotations; Canada, no quotations.
Potatoes—No quotations.
Rice—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
Sugar—Dark Crystals, $5·50

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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Efficiency in Production.

SIR FRANCIS WATTS, K.C.M.G., the Imperial Commissioner of Agriculture for the West Indies, on a recent visit to Antigua, delivered an address to the Agricultural and Commercial Society of that island, much of which, being of general interest, especially in view of these times of reconstruction on which we are now entering, is reproduced below.

There is no doubt that the West Indies, as a whole, have benefited, so far as their agriculture is concerned, from the disturbed conditions of the past four years, and this in common with agriculture in the United Kingdom, in Canada, and America. The terrible struggle from which we are just emerging has made it evident that the welfare of a nation depends on its agriculture as much as, or possibly even more than, on its manufactures, for the food supply is fundamental and of the first consideration. As the outcome of this it seems probable that agricultural matters both in the United Kingdom and in the colonies will have more consideration than they have had in the past, and that brighter times are in view for farmers and planters.

In all this, however, there is some danger lest we be disappointed in matters pertaining to high prices. High prices may be misleading and disappointing if they are universal and affect all commodities and conditions, for this alone would leave individuals just in their former condition: they would receive more money, but they would have to spend it all, as before, in satisfying their needs.

With the era of high prices to which we look forward there will still come keen competition, and success, in the form of profits, will only be secured by competent individuals. With high prices will come increased cost of production, and the margins of profit may remain as before, or may even be less. Relief can only come from efficiency in production, and so we find ourselves back in the old, familiar position, when we had to face the effects of competition in an era of low prices. It is true that we may hope for some relief from some of the peculiar disabilities which affected agricultural interests, and West Indian agricultural interests in particular. But still the fact remains that safety lies in increased efficiency in production.

Increased efficiency in production means making the best use of men, material, land, and machinery, and so covers the widest possible scope. What can best be done to accelerate progress along the desired lines?

In various industries and in various sciences it has been found that the rate of progress is vastly increased so soon as adequate and accurate records are kept concerning the facts with which the industry or the science has to deal; and this is true in agriculture and its allied industries. To illustrate the point reference need only be made to the developments which have taken place in connexion with the sugar manufacture of these islands. In the old days of the manufacture of muscovado sugar, it is not too much to say that no one connected with the industry knew how much cane he handled, or how much sugar or molasses he extracted from it, or how much it cost to produce or to handle; how much, that is to say, in any stage of the process: the end results were known, and that was all. A planter could say, fairly accurately, that an estate made or lost so much money in the course of a series of years, but he could not say just what was happening in each stage of the process of growing and manufacturing. Efforts then began to be made to ascertain what was happening in the process of manufacturing sugar, data were collected, discussed, and sifted, and often disputed, until a settled conviction was arrived at that a deplorable degree of preventable waste was going on. Although this collecting of data took years, it stimulated activity, and directed it into definite channels, so that, eventually in Antigua a sugar factory, working with a most creditable degree of efficiency, was erected, followed by similar progress elsewhere. This was the outcome of definite knowledge concerning the work that was being done under the old system—knowledge wnich led to a recognition of its wastefulness, and to a conviction that change along definite, recognized lines was necessary.

Progress will be greatly facilitated if steps are taken to apply somewhat similar methods to other matters relating to our agriculture. The production of the lands of these islands would be greatly increased if careful records were kept of what each field produces, and of the conditions affecting the growth of the crop. It is not easy to predict just what kind of information would be forthcoming, but it may be predicted that many cases would be found where work is carried on at a loss, and where either remedies could be found for the losses, or the work, with its consequent loss, abandoned, and the effort more effectively applied elsewhere. It has been more than once suggested, and the suggestion is worth renewing, that careful record should be kept of the weight of cane reaped from each of the fields of an estate, and it is more than likely that this is being done in many instances; but it is questionable whether these records are being as carefully studied as they might be in order to extract from them all the lessons which they have to teach. It would be a good thing if owners of properties were to collect carefully the information which is in existence or which can be obtained, and, at the end of each season, discuss the results with their managers, so as to see what information could be extracted for future guidance. Such a course would lead to an intelligent appreciation of fundamental facts, and make useful a mass of statistics which would otherwise probably conduce to but little benefit. After individual results had been discussed, it is fairly certain that points would emerge which might most usefully be brought to the notice of associations, such as agricultural societies, and receive further discussion on the part of the members of them In this way interest would be stimulated, and progressive developments would ensue. It is possible that there are already in existence many records of the kind referred to; it is worth enquiry whether it will not be possible for their possessors to analyse them, and to formulate the facts and lessons to be deduced from them. Benefit would assuredly result, and this benefit would be increased if the information were made public.

Connected with this idea of increased efficiency in production, comes the consideration of the crops produced in a country, and the skill with which they are handled. The principal crop of most of these islands is undoubtedly sugar; this, therefore, may have first consideration.

Sugar-cane growing engages most of the time and energy of planters in the islands where it is the principal crop, and its problems have been fairly carefully studied, though probably the labours of the planter in this direction would be rendered more effective if more attention were to be given to statistical methods of studying these problems. As regards increased production, it may be said that the principal factor governing the success of sugar-cane cultivation in these islands is the rainfall, and that no human efforts can alter that; and further, that such things as irrigation, which are of service in other countries for ameliorating the defects of rainfall, are not likely to be extensively employed in the smaller islands. Still there remain for consideration some matters connected with soil and soil moisture that may well have systematic study, coupled with the careful keeping of records for future guidance. There are methods of ploughing and draining which have a profound bearing on the retention of moisture by the soil. Careful and systematic study will assuredly lead to an understanding of what is best and most profitable

in this connexion. This line of enquiry opens up the whole question of the influence of organic matter in the soil; its effect in increasing the retention of moisture in dry times, and aiding drainage in times of excessive rain; its effect in increasing fertility, and in maintaining that condition of openness and tilth upon which high productivity depends.

Arising again out of this, come the questions connected with manuring, and the fundamental points concerning the production of pen manure and of green dressings. These matters lead to endless others. For instance, what is going to be the effect on estate practice, in the matter of manuring—of the increasing use of mechanical power in place of animal power? Mechanical haulage of produce as exemplified in the factory railways, mechanical ploughing, which is being increasingly adopted, the use of motor cars in place of horse-drawn carriages, and other similar changes all affect the question, and careful planters will study the outlook. Anything which tends to reduce the quantity of pen manure available for an estate is, from that point of view, detrimental, but the advantages of mechanical traction are so great that this will assuredly be persisted in and extended, in spite of this incidental defect.

The defect can be remedied to a considerable extent by the intelligent application of scientific principles. It is essential that fertile soils shall be supplied with the requisite quantity of organic matter; nothing will efficiently replace that. The sources of this organic matter are either the pen manure which we are considering, or green dressings. Now the green dressings are either those which the planter deliberately grows for the purpose, or they arise from the crop residues, such as the cane trash and the cane tops which remain on the land, or from the weeds which grow there, and are ultimately ploughed in. Carefully handled, these things will supply the amount of organic matter which may suffice to keep the land in good condition. A little consideration will show that few properties spend much on imported food for animals, and that such expenditure as is made is laid out on concentrated foods which, while enriching the resultant manure in the matter of nitrogen and other constituents, do not add greatly to the bulk of organic matter, which is the thing we are immediately considering. The loss of fertilizing material arising from lessened purchasing of imported concentrated foods can be made good by the purchase of chemical manures, and no great harm, if any, results. The material used for the feeding of the animals on a sugar estate, largely cane tops and grass, still remains on the property, so that the question is to make best use of them. It is a matter of common experience that these things when turned into the land prove less effective as manures than when they have been fed to animals, so that there seems to be here some loss of efficiency, if these crop residues and similar materials are simply allowed to remain on the ground to be ploughed in. It has been suggested that the increased efficacy of pen manure, as contrasted with the raw material used for the animals' food, lies in the presence in the pen manure of beneficial bacteria, which probably assist in the breaking down of the plant structures, thus permitting their free mingling with the soil, and their more ready availability to the growing crop. At the same time some of the bacteria may be such as are capable of assimilating atmospheric nitrogen, thus adding appreciably to the fertility of the soil. There are grounds for thinking that such bacteria play an important part in maintaining fertility in the tropics.

It is not difficult to apply the principles thus referred to. Should the introduction of mechanical means of haulage lead to an undesirable diminution of animals on any plantation, every effort should be made to produce as much pen manure from the reduced number of animals as was formerly obtained from the full number. To this end, as much fodder as formerly should be brought to the pens, the quantity should be as greatly as possible in excess of the actual food requirements of the animals, the object being to make as much compost as possible. In scientific language this might be described as making a culture of the beneficial bacteria. This may seem a simple suggestion, but it is certain that its use will be attended with good results.

Still continuing to think of the sugar crop, it may be suggested that increased efficiency in production will result from the more extensive use of nitrogenous manures in growing ratoon canes, provided that the plant canes have been adequately treated with pen manure. This is the outcome of the teaching of the manurial experiments conducted in the Leeward Islands and elsewhere.

The increased efficiency in production to be derived from the use of improved varieties of sugar-canes is having careful attention, and, doubtless, will continue to be a matter of serious concern on the part of planters.

MOSQUITO CONTROL.

(*Concluded.*)

The following is the conclusion of the lecture on the above subject by Dr. W. Dwight Pierce, the first part of which appeared in the issue of this Journal for November 30, 1918:—

OILING.

There are many ways of applying the oil. The commonest method is by knapsack sprayer, or, where the ditch is along a road, by horse-drawn tanks fitted with a spraying bar. For slow moving water, and stagnant water, as well as for the treatment of ruts, puddles, hoof prints, and so forth, these methods are satisfactory.

For moving water there are many devices for maintaining a regular dripping of oil from a suspended vessel upon the surface of the water. Such devices can easily be rigged up by any practical man.

The war has brought about, however, some new and even more efficient methods of oiling, which bave been developed along many angles by Dr. Mann, the Post Surgeon, and Lieut. Ebert of the Marine Corps, at Quantico, Va., with the assistance of Pharmacist Mate Duncan. They have found that sawdust impregnated with crude oil will hold it for a long time, and will slowly give it up to the water. They therefore place the sawdust impregnated with oil in a box, and sink it in a flowing stream; or they throw a few grains of sawdust in a hoof print, or a handful on a puddle; or they fix a floating boom to hold at the back of it a quantity of sawdust, and thus give off a constant film. For each condition a slight modification of the application is made, and they obtain an excellent and lasting film, not destroyed by rains.

Dr. Ebert's automatic oiler is a cylinder sunk beneath the surface, which takes in water and displaces the oil, the amount of displacement being regulated by spigots. This oiler, dropped under a bridge in a big river, or placed in a large tidal bay amidst rank vegetation, produces a constantly renovated film of oil which is very effective.

ARTIFICIAL CONTAINERS OF MOSQUITO LARVAE.

In mosquito work much attention must be given to all types of artificial water containers, as rain barrels, cisterns, latrines, tin can dumps, garbage cans, gutters, water pitchers, flower vases, aquaria, table isolation receptacles in tropical countries, cesspools, sewers, toilets, and flushing boxes, traps in sinks, drinking fountains, water troughs, etc. Flushing, periodic emptying, covering with oil films, stocking with fish, are among the possible expedients available in one or another of the cases. Lieut. W. L. van Dine and Dr. W. V. King have devised a new treatment for water in fire barrels and water tanks used for storage of water to be employed in cleansing cans, in each of which cases oil is very indispensable. These receptacles may be treated with borax.

FISH AS MOSQUITO CONTROL.

Among the principal natural enemies of the mosquito are fish; and in permanent ponds and lakes, and in streams, the stocking with the proper species of fish may be considered as one of the most satisfactory methods of mosquito control. In the United States top minnows and gold fish are commonly used for this purpose. The Bureau of Fisheries lists the following American fish available for introduction into American waters infested by mosquitoes: the killifishes, *Fundulus diaphenus*, *F. dispar*, *F. notatus*, *F. chrysotus*, and *F. Nottii*: the top minnows, *Gambusia affinis*, *Heterandria formosa*, *Mollienisia latipinna*. *Enneacanthus obesus*, *E. gloriosus*, *Mesogonistius Chaetodon*, *Centrarchus macropterus*, *Depomis cyanellus*, *D. gibbosus*, *Elassoma zonatum*, *Notemigonus chrysoleucas*, *Labidesthes sicculus*, *Carassius auratus* (gold fish).*

The most complete summary of the species of fish available in various parts of the world is given by Hegh (pp. 140-50). Howard Dyar, and Knab, and also Le Prince and Orenstein discuss the subject.

The Panama larvicide is somewhat toxic to fishes, and undoubtedly some of the volatile oils are also, although the literature speaks only in general terms on this subject.

DESTRUCTION OF ADULT MOSQUITOES.

Howard, Dyar, and Knab, and also Hegh cite various methods of destruction of adult mosquitoes in dwellings, such as puffing powdered pyrethrum into nooks frequented by the mosquitoes, fumigation by burning pyrethrum, sulphur, or cyanide fumigation, vapours of cresyl and of creoline. Le Prince and Orenstein describe a labyrinth trap for windows quite similar to the Hodge window fly trap. Hegh figures and describes other traps.

PROTECTION OF DWELLINGS FROM MOSQUITOES.

In mosquito sections the screening of all habitations against mosquitoes is essential. This must be done thoroughly, and the screens must be carefully examined and repaired. When holes or openings occur in the screening the mosquitoes enter and are trapped, and the building is often worse off than if unscreened.

For protection against Anopheles alone a 16-mesh wire screen is sufficient, but small Aedes can pass through this, and therefore 17 or 18-mesh is necessary. Le Prince and Orenstein give the specifications for the 18-mesh screen to be of 90 per cent. pure copper and not more than one-half of 1 per cent. of iron for damp tropical countries, the gauze having eighteen strands of wire of one-hundredth of an inch diameter in each linear inch. In many parts of the United States other types of wire screening are thoroughly efficient. Mr. F. C. Bishopp has for several years been making tests of serviceability of many types of screening in various parts of the country, and although he has not submitted a final report, will gladly advise anyone desiring this information for official purposes. His address is Box 208, Dallas, Texas.

Where mosquitoes are abundant, the double door vestibule, arranged so that the two doors cannot be opened at the same time, is highly desirable, especially for hospitals. In tropical countries, with verandahs around the entire house, the entire screening of the verandah is essential.

PROTECTION OF THE INDIVIDUAL.

Campers are in the habit of using almost anything that will make a dense smudge to drive away mosquitoes. The fumes of burning pyrethrum powder are not obnoxious to most persons, and are very effective in freeing a room of mosquitoes. This powder, slightly moistened and moulded into a candle, will burn slowly like punk. The essential oil of the powder may be volatilized by placing the powder on a metal screen above a lamp chimney. The odour is only slightly perceptible, and not unpleasant.

For protection of the body, camphor, oil citronella, oil cassia, and other essential oils are found efficacious. Howard, Dyar, and Knab recommend as the best in their experiments:

Oil of citronella	1 oz.
Spirits of camphor	1 „
Oil of cedar	½ „

* In the West Indies anyone desiring to stock a reservoir or other body of water with fish should communicate with the officers of the Agricultural Departments

This may be rubbed on the clothes or body. A few drops on a bath towel hung over the bed will keep *Culex pipiens* away for a whole night.

Graybill lists many repellents against flies, which have been tried on animals. The most successful substances tried by him were 50 per cent. pine tar in cotton-seed oil, or 10 per cent. oil of tar in cotton-seed oil, when applied lightly. Fish oil is a very effective repellent. Bishopp's fish oil repellent is very effective in keeping flies from live stock, when applied lightly. It consists of:—

Fish oil	1 gallon
Oil of tar	2 oz.
Oil of pennyroyal	2 oz.
Kerosene	½ pint

Mosquito nets for the bed are used in many parts of the South where the buildings are unscreened. Campers who sleep in hammocks may easily arange a good sleeping net by tying a rope to the hammock supports, and hanging from this a tent-shaped net, which can be fastened at the ends, and tucked in beneath the blankets.

Hegh illustrates mosquito bars for tent coverings, for tent doors, and soldiers' cots, and also a mosquito bar fastened inside a small soldier's field tent, so that the sides of the tent can be raised to give air. Various types of protective headgear have been described for troops in tropical countries, two of which are illustrated by Hegh.

The references cited below are worthy of study in connexion with this lecture. There are many other works in all languages on the special problems of different countries.

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DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

VIRGIN ISLANDS. During the month of October, 60 coco-nut plants and 500 potato cuttings were distributed, and 10 lb. of cotton seed sold. Regarding staple crops Mr. W. C. Fishlock states that cotton cultivations have responded to the more favourable climatic conditions experienced since the middle of September, and are now, generally speaking, in fair condition. There is a fair local supply of ground provisions, but, in sympathy with St. Thomas, prices rule very high. Quite large patches are being planted, and the aggregate area under these crops must be considerable. The sugar industry is in a bad state. Cotton worm is reported from several districts, and there is a shortage of Paris green. During the month the weather was showery. Rain fell in measurable quantity on twenty-eight days, the total precipitation registered at the Botanic Station, Tortola, being 7·42 inches, as compared with 7·16 inches, the average for the month for the previous seventeen years. Sharp earthquake shocks were experienced on October 11, 14, and 23.

AGRICULTURE IN BARBADOS.

The rainfall for November, though generally a moderate one, has been, as far as distribution is concerned, fairly satisfactory. At the date of writing the total is between 5 and 6 inches, if we except certain districts in the western and south-western portions of the island, where a very heavy rain fell on November 17.

The planting of the young crop proceeds rapidly On the majority of estates all the fields that are to be put under B. 6450 have been planted, and progress is being made with the planting of the other seedlings. The germination of the fields planted three weeks ago has apparently been satisfactory, and already many shoots are to be seen above the banks.

It would appear that, in general, care is being taken with the selection of plants. Most planters have determined not to put in anything except cuttings from plant canes or from nurseries. But here and there we notice estates which planted cuttings from fields of ratoons which are lacking in vigour. This reminds one of the old proverb of saving a penny but losing a pound. We are aware that in some districts there are first ratoons from which very healthy plants can be obtained, but the most vigorous plants are those to be got from plant canes, or from healthy nurseries. Whatever the cost, the best cuttings should be secured, and whatever the waste of cane every cutting which is not in the best condition should be discarded.

This year, too, as in recent years, planters are finding it difficult to complete the manuring of their fields, and, in all probability, this will not be finished before the end of January. And late manuring in any year means a shortage for the next. Planters are doing their best, but it will doubtless mean that the last fields will receive short rations. As in previous reports, we would state that pasture land, if cared, would greatly assist in the accumulation of manure. At present there are several hundreds of acres of grass which yield at most only one-fourth of what they would if they received at intervals an application of sheep manure mixed with mould. The cost would be inconsiderable, and the benefit incomputable.

We learn that limited sales of dark crystals have already been made at $5·20 per 100 lb. and we have heard that a factory owner has made a large engagement of syrup at 50c. per gallon. At this date last year syrup opened at 26c. per gallon, and this price induced a few owners to sell out their entire crops.

Many peasants have taken advantage of the favourable weather, and, since selling cane plants from their small holdings, have put in potatoes and other crops. We are glad to see this, as the cessation of hostilities does not mean that plenty will follow immediately. The future is uncertain and we should maintain intensive production with a prudent use of all foodstuffs. (The Barbados *Agricultural Reporter*, November 30, 1918.)

COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended November 9, 1918, is as follows:—

ISLANDS. The market has remained quiet throughout the week, with only a limited inquiry, which has not resulted in any business, consequently no sales are reported. The Factors are still holding Fine to Fully Fine at 72c., f.o.b. and freight, being encouraged to do so by the sharp advance in Upland cotton and the prospects of peace, which they think will result in a better market and more general demand. Therefore, we quote:—

Fine to Fully Fine, nominally held at 72c., f.o.b and freight.

GEORGIAS AND FLORIDAS. The Savannah market is dull, with limited offerings of the new crop, the stock in Factors' hands consisting largely of old crop cotton, for which there is no demand.

The small sales reported by the exchange was cotton bought in the interior markets, and forwarded to Savannah for shipment.

The demand is very limited, and the market very irregular, being governed by the desire of the holders throughout the interior markets to dispose of some of their cotton, some of them being more urgent than others.

The United States Bureau reports a very small quantity of the crop ginned to November 1, which leads the trade to think that the total crop will fall short of the Government's estimate of 65,000 bales.

We can buy to-day in a limited way, viz:—

Fancy	66c., f.o.b. and freight.
Extra Choice	65c., f.o.b. and freight.

The exports from Savannah for the week have been: to Northern Mills 135 bales; and from Jacksonville to the Northern Mills, 499 bales.

The United States Census Bureau reports the amount of cotton ginned to November 1, as follows:—

South Carolina	1,630 bales				
Georgia	7,860 „	making a total of 14,780 bales			
Florida	5,290 „				
against last year	57,381 „	total crop	88,174	bales	
„ 1916	80,310 „	„	113,109	„	
„ 1915	55,358 „	„	85,278	„	
„ 1914	43,331 „	„	78,857	„	

THE ANTIGUA COTTON GROWERS' ASSOCIATION.

An interim report presented by the Secretary to the Antigua Cotton Growers' Association on its work for the year 1917-18—the second year since its inauguration—shows by the progress made that the Association has done work of a very useful kind.

During the season under report, the Association distributed selected seed to the amount of 3,852 lb. to members and others. Compared with the last season, 2,438 lb. more were distributed this year than last. This seed was obtained from Yeptons estate where selection work on cotton has been carried out by officers of the Agricultural Department for a considerable time.

During the course of the season under review some 600 lots of cotton were purchased, as compared with forty lots purchased in the previous season. The total amount of seed-cotton purchased was 28,509 lb., of which 2,539 lb. were stains, and the remainder clean—an increase of 21,260 lb. over the quantity bought in 1916-17.

The grower in 1916-17 received a total of 13½c. for each pound of seed-cotton sold to the Association; in the present season he has received 16¾c. per lb., and in addition, will receive a further small bonus. The total sum of money paid as second payments to vendors of cotton during the period reported on was $981·72, as against $363·86 in the previous year.

The quantity of lint obtained from the seed-cotton purchased was 7 069 lb.

The Association's useful work chiefly seems to be that it places in the hands of small growers seeds of the best type of cotton available, and, in addition, guarantees that peasants receive a fair and reasonable price for their produce.

COTTON EXPORTS FROM THE WEST INDIES.

The following figures show the quantity and estimated value of Sea Island cotton *exported* from the West Indies for the quarter ended September 39, 1918:—

Colony.	Quantity in lb.	Estimated value, £.
Grenada	1,334	171
St. Vincent	9,754	1,463
Barbados	11,793	1,769
Montserrat	nil	nil
Antigua	53,000	9,938
St. Kitts	2,457	368
Nevis	187,748	28,162
Anguilla	652	98
Virgin Islands	1601 / 200*	1,801	266
Total	268,539	42,235

In addition to the above, 13,829 lb. of Marie Galante seed cotton, of an estimated value of £1,152 were exported from St. Vincent, and 329 lb Native cotton, of an estimated value of £16 from the Virgin Islands.

Except in the cases of Grenada and Antigua, the above values were calculated at the rate of 3*s.* per lb.

The following figures show the quantity and estimated value of Sea Island cotton *exported* from the West Indies for the season October 1, 1917 to September 30, 1918:—

Colony.	Quantity in lb.	Estimated value, £.
Grenada	1,551	204
St. Vincent	384,025	62,980
Barbados	192,981	28,370
Montserrat	265,104	44,335
Antigua	53,000	9,938
St. Kitts	2,457	368
Nevis	187,748	28,162
Anguilla	652	98
Virgin Islands	20,905	2,031
Trinidad	450	75
Total	1,108,873	176,561

* Equivalent of 797 lb. of seed-cotton, valued at £26.

Besides the above there were also exported of Marie Galante seed-cotton from Grenada 496,020 lb., and from St. Vincent 82,409 lb., of the estimated values of £31,035 and £6,319, respectively.

There were also shipped from the Virgin Islands 953 lb. Native cotton lint, and 1,785 lb. Native seed-cotton, of the respective estimated values of £32 and £89.

It is to be noted that, owing to transport difficulties, the amount of cotton exported during this season by no means represents the total crop produced. Much cotton still remained on hand ready for export at the end of September.

ORDINANCES RELATING TO COTTON.

In the Presidency of St. Kitts-Nevis two Ordinances relating to the cotton industry have recently been passed: the Cotton Stainer Ordinance, which is No. 7 of 1918, and the Cotton Ordinance, which is No. 8 of 1918, both being dated September 19, 1918.

The former of these, the Cotton Stainer Ordinance, has for its object the control of the cotton stainer, and it follows closely the St. Vincent Ordinance, No. 16 of 1916, and the amendment No. 3 of 1918, which were enacted for the same purpose, i.e. the control of the cotton stainer. The means by which it is hoped to bring about this control are the elimination of the food-plants of these insects other than cotton, and the destruction of cotton stainers in, and in the neighbourhood of cotton ginneries and storehouses. The Cotton Ordinance establishes a close season for cotton in the islands of St. Kitts, Nevis, and Anguilla.

The island of St. Kitts is divided into four districts, A,B,C, and D. The close season varies with the district, being about six weeks in duration in each case, the dates being fixed for the three districts A,B,C. The dates given are District A from February 15 to March 31; District B, January 15 to February 28; District C, December 15 to January 31. In district D, and in the islands of Nevis and Anguilla, the close season is to be fixed by proclamation.

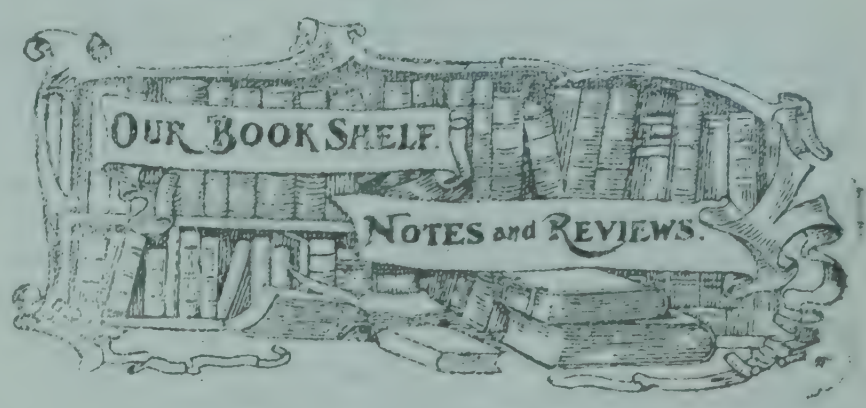
In Montserrat, the Cotton Stainer Ordinance, No. 4 of 1918, dated August 20, 1918, also follows the similar Ordinance of St. Vincent, and like that and the Cotton Stainer Ordinance of St. Kitts, has for its object the destruction of the food-plants of the cotton stainer other than cotton.

The several articles dealing with the control of cotton stainers in St. Vincent, which have appeared in the *Agricultural News* and *West Indian Bulletin*, indicate the conditions resulting from the working of these Ordinances. In the main, the principle involved is that there shall be a time in each year when no cotton shall be planted or allowed to grow in any district or island, and that all food-plants of cotton stainers other than cotton, shall be eliminated, so that they will be unable to survive.

So far as experience goes, the principle is perfectly sound, and in St. Vincent, where two Ordinances have been in operation together, cotton stainers have remained a pest only where carelessness or wilful disregard of the law has resulted in neglect to comply with its provisions.

Now that the relation of the cotton stainers to the attacks of internal boll disease is well understood, the importance of controlling these insects will be more clearly realized than ever before. The close season will be of value in combating the leaf blister mite also, and, in conjunction with the destruction of food-plants of the stainer, will thus serve a double purpose.

The close season of Montserrat, as fixed by the Cotton Ordinance, No. 5 of 1914, is a season during which no cotton shall be sown or planted, and it is given as extending from September 1 to March 31 following. It is, however, provided that, all cotton plants planted before the month of September in the previous year must be destroyed on or before the last day of February. This provides for a period of one month during which there shall be no cotton growing in the island.



A MANUAL OF DANGEROUS INSECTS LIKELY TO BE INTRODUCED IN THE UNITED STATES THROUGH IMPORTATIONS. Edited by W. Dwight Pierce, Entomologist, Southern Field Crop Insect Investigations, U.S. Bureau of Entomology.

This manual was issued in 1917, from the Office of the Secretary, U.S. Department of Agriculture, being a contribution from the Bureau of Entomology, L. O. Howard, Chief in collaboration with the Federal Horticultural Board, C. L. Marlatt, Chairman.

This publication is a compilation of information for the purpose of aiding those officials of the Federal Horticultural Board, Bureau of Entomology, and others who have to do with the work of inspection and quarantine of imported plants for the prevention of the introduction of insect pests. The insect pests of all parts of the world are listed under plant headings, the plants being arranged alphabetically under the American common names, with the technical names following. Many of the insects are described, some illustrated by means of photographs or drawings, while others are merely listed. In this latter group are included many insects the importance of which is not fully known, and others of which there is but scanty information to be had. In subsequent issues of this manual, which are certain to follow, many of these will be better known, and more information regarding them will be available.

This ought to be a very useful book for the purpose for which it was intended. Its real value can only be determined by those who have to use it. The references to the crops and other plants in the West Indies, and their insect pests which might be introduced into the United States appear to be clear and comprehensive.

It is useful not only for the inspectors of imported plants in the United States, but in all situations where attempts are being made to prevent the introduction of pests with imported plants. The agricultural officers in the Windward and Leeward Islands have been provided with copies of this book as an aid in their work of plant inspection and fumigation.

In the very nature of things it can hardly be expected that such a compilation as this could be perfect and complete, and when it has been used and tested, many additions of host plants, and distribution localities will become available.

A manual such as this makes an easily available basis for additions and emendations in addition to its first function.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* / Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

CLERICAL STAFF.

Chief Clerk	A. G. Howell.
Clerical Assistants	L. A. Corbin. / P. Taylor.* / K. R. C. Foster.
Typist	Miss B. Robinson.
Assistant Typist	Miss W. Ellis.
Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

VOL XVII. SATURDAY, DECEMBER 14, 1918. No. 434.

NOTES AND COMMENTS.

The editorial in this number deals with the important subject of efficiency in crop production.

Insect Notes on page 394, give the first part of a summary of the entomological information published during the year.

The concluding part of a lecture on mosquito control is reproduced on page 388.

A portion of a report dealing with diseases of coconut trees in Grenada forms the subject of Plant Diseases on page 398.

Mongoose not in Tobago: A Correction.

The editorial in the *Agricultural News* for November 2, 1918, dealt with the occurrence of rats and mongoose in the West Indies. The statement was made that Tobago was one of the islands in which the mongoose was known to occur.

Since that number of the *Agricultural News* was issued, a letter from the Commissioner-Warden of Tobago has been received, stating that the mongoose does not occur in that island, and that its importation is prohibited by law.

In the first paragraph therefore of the editorial referred to, Tobago should be omitted from the list of islands in which the mongoose occurs, and on the following page (338) it should be included among those islands in which the mongoose does not occur, and where there are laws against its importation.

Johnson Grass in Fiji.

Attention has been drawn on several occasions in previous issues of the *Agricultural News* to the fact that Johnson grass is capable of becoming a very serious pest especially on sugar-cane estates.

Some information from Fiji about this grass has lately been received at this Office. It appears that in two different islands in the northern part of the Fijian group it was introduced about twenty-five years ago. After apparently favourable experiences for a few years the grass was widely distributed, with the best of intentions, but with the worst of results. On one of these islands there are about 25,000 acres under sugar-cane, about 15,000 acres of which are badly infested with Johnson grass, the remaining 10,000 being as yet uninfested. One estate in this district, about 500 acres in extent, is so badly infested that it requires eighty coolie labourers and forty horses to keep it in proper order, whereas fifty labourers and thirty horses would suffice, if Johnson grass had not to be contended against. The tonnage of cane on the badly infested land is also seriously decreased. Strenuous precautions are being taken to avoid the introduction of this grass into uninfected estates and plantations.

Johnson grass is not only freely propagated from its underground stems, but it is also widely distributed by seed, which it produces in abundance. It grows luxuriously on rich alluvial soils, and does very much better than cane on poor soils. The opinion in Fiji is that Johnson grass is the worst weed pest with which the sugar-cane planter there has to contend.

The Montreal Commercial and Industrial Museum.

The editorial of the *Agricultural News*, September 7, 1918, drew the attention of West Indian producers to the advantage offered them of exhibiting their products in the permanent Commercial Museum established at Ottawa. This article has come under the notice of the Director of the Commercial and Industrial Museum of Montreal, who writes to the Imperial Commissioner

of Agriculture, that under the auspices of the Provincial Government in Quebec, a commercial and industrial museum is being organized in Montreal. Professor Laureys, the Director, states that it is desirable to have in the museum nearly all the West Indian products mentioned in the editorial referred to, and that he is sure it would be to the advantage of West Indian producers to have their goods exhibited in Montreal, the city which is practically the commercial metropolis of Canada.

The object of the Museum is to stimulate commerce by demonstrating to Canadian dealers and manufacturers what may be produced and manufactured at home and abroad.

In the next place, as the names of exhibitors accompany the products and samples, the Montreal Commercial and Industrial Museum constitutes for both Canadian and foreign manufacturers and producers a cheap and permanent means of advertising their goods.

The collections of the museum are intended to contain samples of all the natural and manufactured products of the world. Labels of exhibits will give summarized information concerning the processes of cultivation and fabrication, and concerning the properties and uses of the different raw materials and products.

All samples are exhibited, classified, etc., free of any charge. All specimens may be exhibited with the names of the persons or firms furnishing them.

The address of the Director is Professor H. Laureys, Director of the Commercial and Industrial Museum, 399 Viger Avenue, Montreal, Canada, who will give any further information required to intending exhibitors.

Antigua Government Granary.

In spite of several untoward accidents which have happened to the machinery of the Granary, the work performed during the months of August and September makes a considerable showing. The quantity of cob corn received for drying from August 26 to September 7 amounted to 43.499 lb. Work was commenced at the Granary on August 26, but unfortunately the engine broke down about midday of the following day. The repairs were not finished until September 5, and operations were completed on September 7, so that the above mentioned quantity of corn was shelled and dried in four days.

The total amount of dried corn obtained from the quantity of cob corn stated above was 28,655 lb., giving a percentage of dried corn to cob of 95·87. The shelling and drying of the above amount cost £5 4*s.* 5½*d.* with a further cost of £1 5*s.* 4*d.* in connexion with the bagging of the dried corn, making a total of £6 9*s.*. 9½*d.* Roughly speaking, 256 bags of corn or 512 bushels were dried. It will be seen that as the drying of corn is charged for at the rate of 4*d.* per bushel, there is a fair margin of profit to the Granary on the transaction.

One of the difficulties that the Granary has had to contend with during the season was scarcity of water: it was very difficult to obtain really sufficient to run the engine. The other was the serious breakage referred to above, which might have resulted in great damage, had it not been for the presence of mind of one of the mechanics. These difficulties, it is satisfactory to know are now things of the past, and the Granary, it is to be hoped, will continue to do much useful work in the future.

Food-Plants of the Pink Boll Worm.

The plants which furnish food for the development of the pink boll worm larvae have been a subject for some discussion. Cotton of course is a recognized food-plant wherever this insect occurs. In Egypt, okra (*Hibiscus esculentus*), til (*Hibiscus cannabinus*), and hollyhock (*Althea rosea*) were known as food-plants.

In India, hibiscus and 'trees with oily seeds' were recorded as food-plants, while in the Hawaiian Islands the milo, known in the West Indies as 'John Bull', mahoe or gamboge (*Thespesia populnea*). was given as a food-plant of this insect.

In a paper on the pink boll worm, Mr. August Busck, of the United States Bureau of Entomology, who spent some time in Hawaii studying the pink boll worm, stated that only plants of the genus Gossypium, that is to say, cultivated or other cottons, were attacked by this insect.

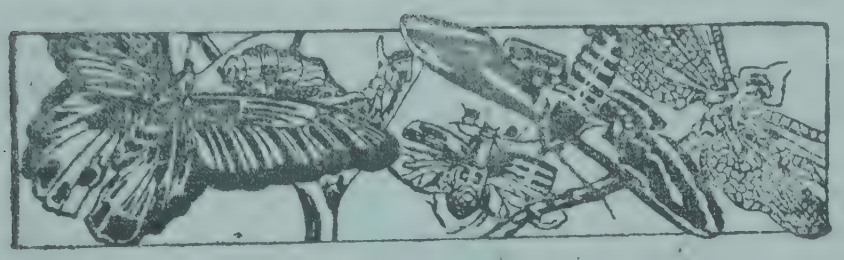
In a letter recently received from Mr. C L. Marlatt, Chairman of the Federal Horticultural Board, who is in charge of the work being carried out for the eradication of the pink boll worm in Texas, and is carrying on observations and experimental work in Mexico, it is stated that 'our experimental work in Mexico has developed very conclusively that the pink boll worm does feed rather readily on okra and hollyhock, and, in fact, under a little stimulus will feed on almost anything. Nevertheless it remains perfectly patent that cotton is the favourite food-plant, and that these others are exceptional.'

These results as to the feeding of the pink boll worm on okra and hollyhock stand as a correction to the conclusions of Mr. Busck, and tend to confirm the observations of workers in Egypt and India. They constitute an additional warning to the cotton growers in the West Indies as to the great care necessary to prevent the introduction of this insect into these islands. One of the ways in which an introduction might occur was mentioned in the last number of the *Agricultural News*, where reference was made to the arrival at Barbados of a schooner, part of the cargo of which was infested cotton seed from Brazil.

The Earthquake in Porto Rico

A severe earthquake occurred in Porto Rico on October 11. The city of Mayaguez on the west coast seems to have been the centre of this earthquake, although it was severely felt all over the island. At Ponce, a large city on the south side, seven men were killed and the damage reported at $250 000. The loss of life in the island is estimated at 200 persons and the damage at $5,000,000.

The sympathy of the neighbouring islands is sincerely felt for the sufferers.



INSECT NOTES.

SUMMARY OF ENTOMOLOGICAL INFORMATION DURING 1918.

For several years past it has been customary for a summary to be prepared of the entomological information which has appeared in the *Agricultural News* during each year. This was not done, however, for the years 1916 and 1917.

Information relating to entomological subjects is usually to be found in the *Agricultural News* on the page or pages devoted to Insect Notes. It sometimes happens, however, that notes of particular importance are included in a number of the Journal after the Insect Notes columns are full, and these together with small articles of general interest are at times to be found in other places.

In addition to notes on insects in the *Agricultural News*, the departmental contributions to entomological knowledge are published in the *West Indian Bulletin*, the Pamphlet and Handbook Series, and in the Annual Reports on the Agricultural Departments in the several islands. During the year 1918 there have been no pamphlets or handbooks issued. Of the *West Indian Bulletin* three numbers have been published during the year, and the usual set of reports for the Windward and Leeward Islands have appeared.

The *West Indian Bulletin* articles dealing with entomology are five in number. Two of them have presented reviews of the prevalence of pests and diseases in the West Indies. That for the year 1916 appeared in the *West Indian Bulletin*, Vol. XVI, p. 309, and that for 1917 at page 83 of Vol. XVII. A review of this, which appeared in the *Agricultural News*, is mentioned at another place in this summary. The other articles referred to were included in the first number of Volume XVII: 'Notes on Certain Plant Bugs connected with Cotton in St. Vincent', by J. C. Hutson, Ph.D.; 'Some Effects of Cotton Stainer Control', by W. N. Sands, F.L.S.; and 'Notes on Trapping the Cotton Stainer in St. Vincent', by W. N. Sands F.L.S.

The notes on insect pests in the reports on the working of the agricultural departments of the several islands for the year 1916-17 are briefly summarized below:—

GRENADA. On page 11 of the report, experiments with a parasitic fungus of the cacao thrips are noted. Cultures of the fungus (*Sporotrichum globuliferum*), which was originally obtained from St. Vincent, were sent by the Imperial Commissioner of Agriculture for the West Indies to the Grenada Agricultural Department. Several trials were made of this fungus which was later found to occur naturally in Grenada.

The notes under the heading Insect Pests and Diseases on page 12 of the same report are largely taken up with Dr. J. C. Hutson's report on his visit to Grenada in January 1917. It refers to cacao thrips and to the occurrence of froghoppers in sugar-cane. The visit to Grenada of Mr. C. B. Williams, Entomologist in charge of Froghopper Investigations, Trinidad, is mentioned. The usual insect pests of the staple crops of the island are recorded.

Plant legislation in Grenada is summarized on page 29 of the report.

ST. VINCENT. On page 11 of the report on the Agricultural Department of this island are to be found notes on work connected with insect pests and their control. These notes are devoted to an account of the investigations connected with the study of the cotton stainer bug (*Dysdercus delauneyi*), and the control or remedial measures adopted. The control measures recommended include the destruction of wild food-plants; close season—February to May, or longer; collection of stainers in the field; trapping the pests; and general inspection and supervision to prevent any breeding and feeding place passing unnoticed, and in order to observe the first indication of the development of the pest in any district or locality.

Plant legislation in St. Vincent is summarized on page 33 of the report.

ST. LUCIA. The insect notes in the report on the Agricultural Department of this island, (p. 5), consists of a brief summary of the plant legislation in force in the island. The increase in the exports of honey, and the attention paid to bee keeping during the year are mentioned also on page 11. Notes on the trials for the control of ticks are to be found on page 18.

DOMINICA. The report on the Agricultural Department of this island contains, on page 33, notes on the work connected with insect and fungus pests and their control. It is stated that, on the whole, the lime cultivation of Dominica continues to be remarkably free from serious insect and fungus pests.

Plant legislation in force in Dominica is reviewed on page 59 of the report.

MONTSERRAT. The notes on work connected with insect pests appear on page 26 of the report on the Agricultural Department of this island. They consist principally of a discussion of the situation as to the cotton stainers, together with observations on an outbreak of the corn leafhopper.

Plant legislation in force in Montserrat is reviewed at page 38 of the report.

ANTIGUA. The occurrence of insect pests of sugar-cane, cotton, limes, sweet potatoes, Indian corn, and onions is mentioned on page 16 of the report on the Agricultural Department of this island. On page 28 there is a short note on the benefits resulting from spraying and dipping for the control of ticks. On page 35 there is a review of the plant legislation in force in Antigua. The supplement to the report deals with the agricultural work in the island of Barbuda, and contains references to a few insect pests.

ST. KITTS-NEVIS. The insect notes on page 12 of the report of the Agricultural Department refer to a few pests of sugar-cane and cotton, and a brief review of the plant legislation in force in the Presidency is also given. Notes are also given on page 36, with respect to certain pests of cotton and the disinfection of plants.

The following references are to insect notes and articles in Volume XVII of the *Agricultural News*:—

Insect pests in Barbados. The insect notes on page 58 present a review of the annual report of the Barbados Department of Agriculture for the year ended March 31, 1917, which contained a list of the insects (except Coccidae) and mites of Barbados, together with notes on the pests of sugar-cane and cotton.

Insect pests of St. Lucia, 1916-17. That portion of the annual report on the Agricultural Department, St. Lucia, 1916-17, which deals with insect pests was reviewed at page 82. This largely consisted of a report by Dr. J. C. Hutson

on a visit to that island in July 1917, to investigate the habits of the black weevil borers of bananas (*Cosmopolites sordidus*). Other insects attacking the banana and plantain, insect pests of limes, and notes on miscellaneous insects in St. Lucia were also dealt with in this report.

Cacao thrips in Grenada in 1916-17. During 1917 Mr. F. W. Urich, Entomologist to the Board of Agriculture, Trinidad, was requested by the Government of Grenada to visit that island and examine into the conditions of the cacao thrips. Mr. Urich's report was reviewed at page 362.

Insect pests in the West Indies in 1917. The report on the prevalence of insect pests in the West Indies in 1917, which appeared in the *West Indian Bulletin*, Vol. XVII, p. 83, was reviewed at page 378. This report was the ninth in the series of similar reports compiled from the reports of the agricultural officers in the several islands.

Some insect pests in Cuba. At page 186 an account was given of some insect pests in Cuba. These were the spiny citrus white fly, the sugar-cane mealy-bug, and the frog-hopper. It might be well at this place to mention the article which appeared at page 174, entitled 'The Organization of Plant Sanitation in Cuba', giving an account of the organization, and the object for which it was created, of the Commission of Plant Sanitation, which was constituted by Presidential decree in 1916.

Insect notes from Porto Rico. These notes on page 314, consisted of abstracts of three papers from the Insular Experiment Station, Porto Rico, entitled 'The Egg-plant Lace bug,' Scale-feeding habits of Porto Rico millipedes,' and 'Scale insects and their control.' These papers were all by Mr. R. T. Cotton, Assistant Entomologist.

Insect pests in Uganda. The report of Mr. C. C. Gowdey, Government Entomologist, Uganda, for the year ended March 31, 1917, was reviewed at page 26. This dealt principally with insect pests of coffee, cotton, rubber, and fruit trees.

H. A. R.

(*To be continued.*)

COCOA IN AMERICA.

In a recent number of the *West India Committee Circular* (September 19, 1918), prominence is given to the increased attention which is being paid to the advantages of cocoa in the United States, as reflected in an article in *Dunn's Review* for August last. Cocoa, i.e. the product of the cacao tree, the writer states, has long been regarded as one of the foremost staples of international commerce, and at present is held in higher regard than ever before throughout the civilized world. Scientists called the cacao plant the 'Food of the gods', and several commercially important countries and colonies derive most of their prosperity from its cultivation.

Quoting from a recent report of the Bureau of Foreign and Domestic Commerce on the subject, it is stated that at present, when the world's attention is being concentrated on food supplies as never before, and the food value of articles is being carefully weighed, cacao and its products will receive special attention because of their admittedly high nutritive qualtities. Chocolate for a long time has been recognized as possessing these qualities in concentrated form, and it is a staple part of the contents of the pack of mountain climbers and polar explorers. For soldiers and sailors it is a welcome addition to the regular rations, especially as it is easily preserved. Every comfort kit' made up for American fighting forces, says the writer, contains a cake of sweet chocolate, which supplies nourishment and the necessary element of sweets in the diet of the man in the trenches or on ship-board, and at the same time gives him the satisfaction of having one of the luxuries available to him in peace-times. The importance of chocolate and cocoa for army and navy purposes has been recognized by the War Trade Board in laying out its policy with respect to the restruction of imports.

The changes in the import trade in cocoa into the United States since the war are shown in the following table for the fiscal years 1914 and 1917 :—

IMPORTS OF COCOA INTO THE UNITED STATES IN 1914 AND 1917.

	Fiscal year 1914.	Fiscal year 1917.
Imports from	lb.	lb.
Europe	39,227,120	28,218,341
Costa Rica	73,316	1,359,411
Panama	121.547	1,020,808
Jamaica	962,292	2,799,170
Trinidad and Tobago	39,672,729	31,083,312
Other British West Indies	3,427,405	6,257,436
Cuba	2,818,188	1,181,762
Dominican Republic	26,782,966	61,443,869
Haiti	2,245,943	3,357,836
Brazil	25,870,186	51,461,624
Ecuador	26,319,735	67,227,698
Dutch Guiana	4,051,868	4,100,961
Venezuela	4,003,464	16,493,654
British West Africa	7,895	40,424,917
All other countries	682,992	3,223,077
Total	176,267,646	339,653,876

The enormous expansion in the imports into the United States indicated in the foregoing table was, it is pointed out, primarily due to the fact that the great trade with Hamburg, which existed prior to the War, has ceased entirely, these exports now finding their way for the most part to New York. The Netherlands was also a heavy importer prior to the War, but that trade has been much restricted, and at present (1918) is almost negligible. Shipments to France and England are also on a reduced scale, hence the United States has become the main reliance of the exporting countries of the Caribbean region, Central and South America. But for the greatly increased American importations, many of these countries would now be facing severe financial difficulties instead of which, generally speaking, it may be said they are quite prosperous with their leading staple selling freely, at fairly high prices. In the current year exports from Venezuela, it is said, are likely to show a marked decline, but otherwise the movements, indicated in the figures given in the table quoted above, will probably be continued.

Several of the shifts in this trade indicated by the table are of more than passing interest. The Dominican Republic, for example, increased its sales in the United States market by more than 100 per cent in the period under review, while Brazil increased her shipments by almost precisely 100 per cent. Ecuador also more than doubled her trade with the United States, most of the crop of that country having gone to Europe—chiefly to Hamburg—prior to the War. The most remarkable change of all, from a statistical viewpoint, is the increase in direct importations from British West Africa, from 7,896 lb. in 1814 to 40,424,917 lb. last year. These importations no doubt included large quantities from Portuguese West Africa, shipped via the British possessions.

GLEANINGS.

Abnormally heavy rains were experienced in Tortola during the first ten days in November, the rainfall amounting to 13·07 inches. The heaviest fall of over 4 inches in about six hours occurred on November 9. Following a rainy October, this amount of rain has caused considerable damage to the roads all over the island.

The way in which cement is used as a poison for rats is as follows: Take a roasted or boiled potato; crush it, and mix with the cement—about one-third the mixture must be cement—roll the mixture into balls, and place them in the field. (The *Journal of the Jamaica Agricultural Society*, August 1918.)

The Times for October 21, 1918, reports that its Jamaica correspondent telegraphs that the Government of the island is considering the question of the settlement of natives who have served in the West Indies Regiment on their return from the war. Plans are being discussed for the establishment of communal farms. The Government is to assist to develop the farms. and to market the produce. After expenses are deducted, the balance is to go to the men.

Probably the largest butter manufacturing concern in the world is the North-Coast Co-operative Company, Ltd., Byron Bay, New South Wales. The quantity of butter manufactured for the half-year ended April 30, 1918, was 10,627,543 lb., the average price received being 16¼*d.* per lb. The company also deals largely in hogs, having treated 19,813 carcasses during the same half-year.

A note on citrus cultivation in Surinam, which appears in the *Journal of the Royal Society of Arts*, October 2, 1919. states that a yield of 1,000 fruit per adult tree is not exceptional. The average yield per tree may be placed at 500 fruit. Estimating the sale price at ¼*d.*, per orange, an acre of sixty-five trees, with an average of 500 fruit per tree, would bring in about £40; from this must be subtracted the cost of cultivation, placed at about £4.

It is understood that telegrams have been addressed to all West Indian Colonial Governments by the Secretary of State for the Colonies, stating that the Government has decided to appoint a Committee to consider the probable effect of the shipping position after the war on British trade in the West Indies, and on intercolonial communication, and to report on measures to be taken to maintain adequate communication between the Colonies, and to provide increased port or other facilities for shipping. The Colonial Governments are invited to send representations to the Committee.

Although Spain was probably the first country on the Mediterranean to produce cane sugar after its introduction from the East, it seems now probable that the culture of sugar-cane on the Spanish mainland will cease entirely before many years, the crop having fallen from 16,176 tons in 1912, to 4,584 tons in 1917. (The *Louisiana Planter*, October 19, 1918.)

The quickest way to rid land of Johnson grass (*Sorghum halepense*) is to overgraze with sheep, meanwhile irrigating frequently. The most effective way, as well as the most economical way, is the frequent cultivation of a crop such as corn, followed by another crop demanding much tillage, such as cotton. The method demanding least labour and outlay of cash, is dry fallow in summer followed by grain crops. (The *Experiment Station Record*, July 1918.)

The *Rhodesia Agricultural Journal*, August 1918, states that cultivated varieties of cowpeas very frequently fail to thrive in that country owing to attacks of the stem borer, although cases are reported of excellent crops being produced. The native cowpeas, on the other hand, seem highly resistant to those pests. Of these native beans there are several distinct strains, and these are now being experimented with at the Agricultural Experiment Station, Salisbury.

The *Egyptian Horticultural Review*, October 1918, states that by adding carbonate of soda to the water in which cut flowers are placed, in the proportion of a teaspoonful to a pint, it is possible to lengthen the life of the flowers. The action of the chemical tends to increase the power of absorption in the cells of the plant. A weak solution of camphor and water will have a similar effect. To keep the water sweet and clean, it is an excellent practice to add a small lump of charcoal to each vase.

The *Indian Trade Journal*, August 9, 1918, states that the work on sugar-cane on the part of the Department of Agriculture, Bengal, has shown satisfactory progress. Out of fifty-one varieties selected for tests, forty-one have been eliminated. The tests which are applied are sugar content and fitness for local conditions, which vary greatly throughout the Presidency. Two exotic canes have proved successful, and three local varieties the most popular. The exotic canes give the best yield, but are inclined to deteriorate. There is an increasing demand for sugar-cane cuttings from the Government farms.

The *Weekly Bulletin*, Department of Trade and Commerce, Canada, October 21, 1918, in an article on copra production in the South Sea Islands, says that copra, being the chief article of production and of export of the South Pacific Islands, plays the foremost part in their commercial and material prosperity. It is stated that the approximate average export of copra from the South Pacific before the war was between 70,000 to 80,000 tons per annum.

In the report on the Agricultural Department, St. Lucia, 1917-18, it is stated that there has been rapid extension of cultivation in some of the districts where agricultural credit societies have been established. In other districts, where cultivated areas lacked care and attention, the peasants are endeavouring to improve their small holdings under the instruction of the Agricultural Instructors of the Department, and by the judicious use of money loaned to them for the purpose.

CEREAL CROPS IN MALAYA.

The Government of the Federated Malay States, through the local Department of Agriculture, has been encouraging the planting of foodstuffs and increasing the local production of food. Good progress in this direction seems to have been made, and it is evident that the cultivation of various kinds of cereals is meeting with a considerable amount of success.

An article on the cultivation of foodstuffs, by Messrs. F. G. Spring, and J. N. Milsum, in the *Agricultural Bulletin of the Federated Malay States*, June 1918, deals especially with the cultivation of cereal crops.

The authors state that it seems probable that soon the majority of estates having suitable land will sericusly consider the production of cereal crops. They go on to say that in many instances rubber and coco-nut clearings up to two and a half years old are suitable for the cultivation of cereals, and that the utilization of even a small proportion of such land in this connexion would materially affect the food question in a beneficial way. They consider that a new clearing can support one or perhaps more annual crops which take a matter of a few months to mature without, to any appreciable extent, injurious results to the permanent crop. It is quite possible that the culture and tilth required for the temporary crop will more than compensate for any materials removed from the land. The resultant stubble, when turned into the ground, considerably assists in improving the mechanical condition of the soil, and in this way benefits the permanent crop.

Among the cereals described are three which seem to be at present unknown in the West Indies. It might be well for experiments to be made with these cereals in these islands, seeing that they are evidently suited to tropical conditions, where the rainfall is about 50 inches per annum.

The first of these is known in India as Ragi (*Eleusine coracana*). This is a stout, tufted grass, growing about 2 feet high, producing globular, brown seeds. There are two main classes of the several varieties grown in India—close-headed varieties, and open-headed varieties. Ragi is an important food crop in India, and it is estimated that the total area devoted to this crop for all India averages from $5\frac{1}{2}$ to $6\frac{1}{4}$ million acres. It many parts it is the staple grain, being perhaps the most productive of Indian cereals. It keeps well, and is frequently stored in pits for several years in Mysore. Cakes made of Ragi flour are largely eaten in some parts of India. It is also eaten mixed with rice. The crop begins to mature from five to six months after sowing. The heads ripen unevenly, and are cut as they mature. It is said that a yield of about 2,100 lb. per acre may be reasonably expected from this grain.

Another cereal to which attention is being paid in the Federated Malay States is known as Italian millet (*Setaria italica*). This is a graceful, annual grass, about 3 feet high, producing small, smooth seeds, commonly yellow in colour. This millet is cultivated and eaten in many parts of India. The grain is ground, and is eaten in the form of cakes and porridge. The flour is said to be scarcely inferior to wheat, and makes excellent pastry. When boiled with milk it makes a pleasant, light food. It is a short duration crop, occupying the land for about three months. Seeds sown at the Kuala Lumpur Agricultural Experimental Plantation in the middle of November 1917 germinated rapidly, and the crop was harvested during the third week of February 1918. It is estimated that a crop of 1,050 lb. per acre per crop might be expected on good land.

The third of the cereals referred to above is bulrush millet, sometimes known as spiked or pearl millet (*Pennisetum typhoideum*). This is described as an erect grass with thick round stems from 4 to 6 feet high, bearing spikes from 6 to 9 inches in length, cylindrical in shape. The seeds are of medium size, smooth, and of a dull, slaty-brown colour. This millet is extensively cultivated in many parts of India, and in districts where it is grown it forms the staple food of the people. The area devoted to this crop in British India is probably well over 10,000,000 acres. The flour is made into cakes and bread. The plant also makes a useful fodder, and is used generally in Madras for this purpose. The crop is ready for harvesting in three and a half months from sowing. The heads are placed in the sun to dry, and the grain is removed by threshing with sticks. The yield is estimated at about 1,800 lb. per acre per crop.

Besides these cereals described above, which are unknown to the West Indies, the Department of Agriculture of the Federated Malay States is also advocating more extended cultivation of varieties of sorghum (Guinea corn), and also of rice, both as an irrigated crop on alluvial soils, and as a dry crop under the hill variety on newly burnt jungle land. Much attention is also being devoted to the improved production of maize.

Market Sought for Capybara Skins.—According to the *Journal of the Royal Society of Arts* for October 18, 1918, a market is at present being sought for Capybara skins. Millions of this animal, which is the largest living rodent, and is common throughout South America from Venezuela to Central Argentine, are found in the Orinoco River and its tributaries, This animal is also known as the 'chiguire', and is sometimes called the 'carpincho'. It is aquatic, inhabiting the marshy banks of brackish streams, and is notorious for the great damage that it does to neighbouring sugar plantations. When full-grown the animal is about 4 feet long, and has a girth of 3 feet, weighing nearly 100 lb. The skin is thick, and is covered with a rough brown coat of short coarse hair. It appears from a report from the United States Consul at La Guayra, that the chiguires have been officially pronounced undesirable animals, and the Government of Venezuela advocates their extermination. No use for their skins, however, has yet been found.

The Board of Trade Journal, October 3, 1918, states that an American company, with a capital of $50,000, is constructing at Colon a factory for the manufacturing of coco-nut oil and palm oil, and their by-products, soap, glycerine, caustic potash, carbonate of potash, soda, etc. The factory will have a capacity for making 1,500 gallons of coco-nut oil and 250 gallons of palm oil daily. An ample supply of coco-nuts can be obtained from the neighbouring territory all the year round. Palm oil will be extracted from the nuts of palm trees growing in various parts of the Republic of Panama, as well as in the Canal Zone.

The Empire Cotton Growing Committee met at the Board of Trade on September 25. At this meeting a scheme for the development and expansion of the Committee's work was put forward in outline, and fully discussed. It is proposed to set up a number of sub-committees to deal respectively with finance, commerce and development, research and education, and the collection and dissemination of information as to cotton growing. (*The Board of Trade Journal*, October 3, 1918.)

PLANT DISEASES.

ROOT DISEASE OF COCO-NUT PALMS IN GRENADA.

MYCOLOGIST'S REPORT.

The most serious affection met with is that which is destroying the trees at the Government plot at Westerhall. It was further met with on two estates visited, and from reports received may occur on several others. The Westerhall plot consisted originally of something less than 100 trees, well spaced out and planted on sloping stony land with a fair depth of medium loam on clay subsoil. The plot would have been the better for close draining when the trees were planted, but there is no suggestion of actual water-logging, and coco-nut trees not far away are mature and thriving under conditions much less favourable in this respect. The age of the trees is some five or six years and the growth made is very good. The trees not yet affected by the disease have an exceedingly healthy and vigorous appearance, and those which are failing were equal to them in condition up to the time when they began to show the symptoms of the disease. The process of failure is somewhat rapid, and its onset definite. At Westerhall it has taken effect about the time when the trees were beginning to bear. In another situation, however, trees were dying before they had flowered, and in yet another after two or three bunches of nuts had been ripened.

In no case could the occurrence of the disease be associated with poor cultural conditions or with any lack of vigour or any sign of unhea'thiness whatever apart from the disease in question.

The symptoms of the disease, as they were conveniently exhibited in all stages at Westerhall, are as follows: The outermost, oldest leaf begins to turn yellow at the tip, and the discoloration progresses until the whole leaf is brown. By this time the next leaf has begun to fail in the same way, and this process continues until all the expanded leaves have failed. In older trees examined in another place the leaves which were first to fail, though in all cases mature, were not always the oldest. It is noteworthy that the leaves not yet reached in this process preserve a healthy and vigorous appearance. When the support of the mature leaves is removed from the central column of partially expanded leaves death is accelerated by secondary causes. The unripened tissues are not usually strong enough to support the weight of the column, and their natural weakness may be increased by the admission of palm weevil. There is further the tendency for the young tissues near the bud of a failing tree to become involved in a putrid bacterial rot. This is not necessarily related to the specific infectious bud rot which attacks normal trees, and I saw no sufficient evidence of the presence of this in the cases which came under my notice. What is observed is the bending over of the top while it is still green, with a rapidly developing infestation of palm weevil in some cases, of a putrid rot in others, and sometimes of both together. During the progress of the disease there is also very commonly a firm brown wet rot in large patches on the expended leaf bases, and there may be similar smaller patches on the petiole higher up.

I regard the whole of the symptoms so far described as secondary, consequent on the condition of the roots. Even in trees which outwardly are just beginning to fail a large proportion of the roots are already affected from without inwards almost or quite to their points of attachment. The coco-nut root consists of a hard outer shell and a central woody strand, with pure white cortical tissue of loose consistency between. This cortical tissue appears to be the seat of the trouble. While the woody central strand still appears quite healthy the cortex becomes dry and flaky and passes through stages of discoloration from white to light yellow, then to dark yellow and brown; finally the root becomes obviously dead and rotten. This condition is well advanced before the failure of the top has progressed very far.

When the stem of a tree in any stage of the disease is cut through, there is seen a well marked red ring 2 to 3 inches wide lying 2 to 3 inches from the exterior. It is of greater or lesser intensity, and extends in a well marked form to a greater or lesser height in the trunk according to the stage the disease has reached. High up in trees with the central column of the leaves intact the ring is resolved into separate reddened strands in the soft stem and in the petioles of leaves still green and vigorous in appearance.

In no case reported, so far, has recovery from this disease ensued. There is no very definite evidence of its communication from tree to tree, but in the case of the Westerhall plot appearances suggest that all the trees will eventually be killed. Two other instances of plots in which the affection appears likely to become general were seen; a few cases were reported as apparently isolated in their occurrence.

The symptoms of the disease agree completely with those of the root disease of coco-nuts prevalent in Trinidad and Tobago, first described by F. A. Stockdale in 1906, and more closely investigated later by J. B. Rorer. (Stockdale, *West Indian Bulletin*, Vol. IX, pp. 362-71. Rorer Circular No. 4 Bd. of Agric., Trinidad and Tobago, pp. 27-33.)

Rorer reports the result of an extensive mycological examination, in which 194 cultures were made from diseased material, as having proved entirely negative so far as the recognition of any causative organism is concerned. He may be considered to have shown convincingly that Stockdale's idea of the causation of the disease by the fungus Diplodia is without foundation. Rorer's investigations, extending over a period of two years, led him to the conclusion that no fungus parasite is involved, and he was forced to regard the disease as arising from unfavourable conditions in the soil. What these conditions are, 'whether it is the lack of some element necessary to the continued growth of the coco-nut tree, whether it is the presence of some substance which is toxic to coco-nut roots, or whether it is due to acidity or lack of aeration in heavy soils it is difficult to say.' A point he considers worthy of note is that the disease is frequently met with on old sugar land.

It is difficult to reconcile the apparently sudden manifestation of the disease in trees which for five or six years have grown with maximum vigour with any hypothesis of the lack of an essential element from, or the presence of a toxic substance in, the soil. The definite and seemingly specific characters of the disease are against the suggestion that it is due to the physical condition of the soil, since the ordinary effects of poor aeration and heavy untilled soil are well known to result in a general sickly appearance of the tree, poor growth, and infestation with scale insects. Moreover

the observed condition of the soil in the Grenada cases lends no colour to this suggestion.

My observations in Grenada agree with those of Rorer in Trinidad as to the absence of any fungoid or bacterial parasite in such association with the disease as to suggest its causation. In all cases examined in Grenada, however, in situations as much as 10 to 15 miles apart, each smallest flake of the affected cortex in each of a large number of roots collected and examined, contained nematode worms of what seemed to be in all cases the same species, judging by the gross characters of size and general form.

A nematode theory of origin would seem to fit exactly the characteristics and mode of occurrence of the disease as described. It would supply the adverse agent in the soil which Rorer's studies led him to postulate, without conflicting, as his hypotheses of unsuitable chemical or physical conditions do, with the observed characters of the soil in these respects. The decision as to its probability will largely turn on the association of nematodes with the production of the exactly similar symptoms of the Trinidad disease. Steps have already been taken to make the necessary comparison.

Pending decision as to the tenability of this theory, the advice now offered can only be tentative. There may be considerable significance in Rorer's observation that the disease most commonly arises on old sugar-cane lands, which is confirmed, so far as the few cases yet examined go, by the Grenada experience. Some light may be thrown on this aspect of the case when the worm has been submitted to a specialist for identification. The most obvious measure, at this stage of information on the subject of the disease, is the application of a complete system of narrow deep isolation drains to the whole of plots or sections of fields in which this disease has made its appearance, dividing up the cultivation into squares, each carrying a single tree. This course of action I strongly recommend. It would seem to be useless to replant places in which trees have died until a period of perhaps two or three years has elapsed. If cultivation is carried on in that period it would seem desirable that sugar-cane and banana should be avoided. Cassava may be suggested as a suitable crop. Heavy liming and deep cultivation can be expected to help in cleaning up the soil. Trees which show definite signs of attack may as well be cut down at once. The disposition of the top, apart from the possible encouragement of palm weevil, is a matter of no consequence. The succulent parts might well be used as a weevil trap.

As evidence of the destructiveness of the similar and probably identical disease in Trinidad, and in justification of a serious view being taken of the Grenada disease, Rorer's remark may be quoted that 'at one time many of the hillsides in the windward district of Tobago were well covered with coco-nut palms, but now one sees only a few trees here and there, the rest having all died off as a result of the root trouble.'

By courtesy of the Acting Director of Agriculture, material collected by Mr. Rorer in his investigation of the Trinidad root disease of coco-nut has been received and examined. A nematode worm, which so far as I am able to judge is the same as that found in all the Grenada material, is present in abundance in these Trinidad specimens. This supports, so far as it goes, my theory as to the causation of the disease by nematodes. I hope to extend my observations on this point during my forthcoming visit to Trinidad.

Wm. Nowell

(To be continued.)

EQUATORIAL EXPERIMENT STATIONS.

A pamphlet has recently been received at this Office, written by V. H. Kirkham, Government Analyst, Nairobi, British East Africa, in which is outlined a scheme for the establishment of agricultural experimeut stations in the East Africa Protectorate, which seems likely to make tehse stations not only of local value, but of universal interest. Most of this pamphlet is for this reason reproduced below.

The Government of the East Africa Protectorate, with the approval of the Secretary of State, has made provision for the inception of a scheme of research directed towards the exploration and development of the resources of East Africa.

This country and the adjacent Protectorate of Uganda are the only portions of the British Empire through which the equator passes. The Uganda railway, in its 580-mile tract from the coast to the Victoria Nyanza, rises from sea-level nearly 8.000 feet to the edge of the escarpment of the Great Rift Valley, drops into the valley 2,000 feet below, rises again to cross the western side at an altitude of 8,320 feet, and then descends into the Nyanza basin, terminating on the lake shore 3,726 feet above sea-level. The meteorological conditions are as diverse as the changes in altitude; temperatures vary from the intense heat of the tropical coast belt to sharp night frosts in the highlands; rainfall varies from 10 inches to 80 inches per annum.

It is intended to conduct local research upon scientific lines, and to observe the effects of the different meteorological conditions upon the most extensive collection of endemic and exotic plants which can be assembled.

It is hoped that within the next twelve months plots will have been cleared and laid out at every interval of 1,000 feet in altitude, from sea-level to 9,000 feet. It is proposed to plant these plots according to a uniform plan, and to adopt a uniform method of treatment throughout. Meteorological data will be obtained and registered at each station. Laboratory work and microscopic examination of plants will be carried out in the Government Laboratories at Nairobi.

It is proposed to arrange the work in two schedules: (A)—plants under experiment; (B)—plants under observation.

The number of kinds of plants which could be dealt with in schedule B is almost unlimited, and it is with a view, Mr. Kirkham states, to obtain assistance from the outside world in collecting seeds, bulbs, etc. of the greatest possible variety, that this brief account of the scheme is being circulated. The behaviour at the different stations of plants grown from material thus received will be duly notified to the donors.

It is hoped that these equatorial experiment stations may arouse interest in other countries, and that this interest may be shown by gifts of the most varied assortment of material for schedule B.

In addition to helping with material, it is hoped that those interested will notify their wish to receive annual reports, and will make any suggestions which may occur to them. Correspondence will no doubt result in collaboration with workers in other latitudes, whereby the correlations of observations may lead to the evaluation of some factors in plant growth which it might not be possible to obtain by experiments in any one latitude.

Correspondence, suggestions, pamphlets, material, etc., will be cordially welcomed, and should be addressed to the Government Analyst, Nairobi, British East Africa.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, August 22.

ARROWROOT—No quotations.
BALATA—Venezuelan Block, no quotations; Sheet, no quotations.
BEESWAX—No quotations.
CACAO—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 4/6 to 5/-; concentrated, quiet; Otto of lime (hand-pressed), 16/6
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—9½*d*.
RUBBER—Para, fine hard, 3/0½; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., October 4.

CACAO—Venezuelan, no quotations; Trinidad, no quotations.
COCO-NUT OIL—$1·46 per gallon.
COFFEE—Venezuelan, 15c. per ℔.
COPRA—$7·25 per 100 ℔.
DHAL—$11·50 to $12·00 per bag.
ONIONS—$10·00 per 100 ℔.
PEAS, SPLIT—$8·00 per bag.
POTATOES—English, $4·00 per 100 ℔.
RICE—Yellow, $13·00 to $13·25; White, $9·00 per bag.
SUGAR—American crushed, no quotations.

NEW YORK.—Messrs GILLESPIE BROS & Co., November, 14.

CACAO—Caracas, 14½c. to 15c.; Grenada, 14½c. to 14¾c. Trinidad, 14½c. to 15c.; Jamaica, 12¾c.
COCO-NUTS—Jamaica selects, $51·00; Trinidad $52·00 culls, $28·00 to $29·00 per M.
COFFEE—Jamaica, 14c. to 17c. per ℔.
GINGER—17c. to 20c. per ℔.
GOAT SKINS—Importation prohibited.
GRAPE FRUIT—Jamaica, $2·50 to $4·00.
LIMES—Nominal.
MACE—43c. to 45c. per ℔.
NUTMEGS—30c.
ORANGES—$2·50 to $3·50.
PIMENTO—9c. to 9¼c. per ℔.
SUGAR—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·155c. Molasses, 89°, 5·052c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 18.

ARROWROOT—$12·00 per 100 ℔.
CACAO—$12·00 to $12·50 per 100 ℔.
COCO-NUTS—$30·00 husked nuts.
HAY—$3·00.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations; Patna, no quotations; Rangoor, no quotations.
SUGAR—Dark Crystals, $5·50

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AGRICULTURAL NEWS.

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Efficiency in Production.

THE editorial in the previous number of the *Agricultural News* contained the part of the address by Sir Francis Watts, K.C.M.G., delivered before the Antigua Agricultural and Commercial Society, in which he dealt with efficiency in production as applied to the sugar-cane industry. His remarks on the same subject with regard to minor crops are reproduced below:—

In many of the smaller islands the crop next in importance to sugar-cane is cotton. The various food crops are also very important, perhaps of increasing importance, in view of the augmented cost of imported goods.

The high price which is now being paid for cotton has led to a revival of interest in its cultivation, and it is a matter for consideration whether it is worth while to take those serious efforts, without which it seems that cotton growing is not likely to succeed. It is now pretty generally admitted that community action is necessary if the cultivation of Sea Island cotton is to be carried on successfully. It is found that concerted action is necessary in procuring the right kind of seed and in maintaining its purity, and that concerted action is also necessary in the matter of controlling insect and fungus pests.

In these circumstances it is found best in the Windward and Leeward Islands to entrust the work of seed production to the Government, acting through the Agricultural Departments, and for the Government to make regulations in respect to the control of pests and diseases.

A very important point in connexion with increased efficiency in production is this control. Considerable study in this direction has been undertaken and published by the specialists attached to the Staff of the Imperial Department of Agriculture. Planters should be on the alert to detect attacks, and they will be wise if they follow the directions given by those who have studied the question of control of their insect or other foes.

It would seem certain that the matter of pests and diseases of cotton may best be dealt with by introducing a close season, that is to say, fixing a time when all old cotton plants, or indeed cotton plants of any description, throughout any given districts, shall be

destroyed, and also fixing a time before which no cotton plant may be planted, thus creating a period, at least of about one month, during which no cotton plant is in existence in any given district. Such an arrargement assists greatly in the control of pests and diseases, and creates a barrier which to a large extent prevents the carrying over of these pests and diseases from one season to another. This is not sufficient in all cases, and it still remains for cotton growers to take the proper steps to control such pests as may arise, and it may also be necessary to take other compulsory measures.

It is not necessary now to deal with cotton questions in detail. Suffice it to say that, troublesome though it is, the industry is one which should not be neglected, for it is capable of putting considerable sums into circulation, and of adding considerably to the value of the exports of those islands where the conditions are favourable for the cultivation of this crop.

Reference may be made to the question of the production of food crops as affecting efficiency. Although the war is drawing to a close, it must not be expected that the cessation of hostilities will lead to an immediately increased and cheapened food supply: indeed it is likely that the opposite will be the case. The armies still have to be fed, and it will be some time before the fighting men can turn to the work of food production. Furthermore, the marked shortages of food on the European Continent have to be dealt with from the food supplies of the Allies, and this will tend to consume more than any surplus which might have been created by the vigorous efforts of the past few months. Then again there will remain a serious shortage of shipping, for many of the ships will of necessity be engaged in the work of transporting troops and military stores. Hence we may look forward to a period of some length during which imported foods may be both scarce and dear. It is necessary to provide for this by continuing and even increasing the efforts in the direction of local food supplies. This matter should have consideration on the part both of the local Governments and of the planters if the work is to be carried out in an efficient manner, and the assurance reached that there will be adequate supplies of food to obviate serious discomfort or inconvenience. It may be well if estate owners will undertake to plant a fixed and stated proportion of their arable land in food crops, and if they will carefully consider the nature of the crops to be planted, so as to ensure a proper diversity, and the avoiding of a glut of perishable material.

The cultivation of corn, and peas and beans which are capable of being stored, will doubtless have due consideration. The existence in some islands of grain driers is a fact of some importance, of which full advantage should be taken. The excellent work that has been done in St. Vincent in connexion with the grain drier which has been erected and operated in that colony makes evident how useful such an appliance is when properly used in conjunction with such things as adequate storage bins, grinding mills, and other accessories. It may be pointed out that in that colony planters and merchants availed themselves of the means of ridding grain from weevils and moulds, and of storing it for short periods until required for use, whereby much food was saved to the colony.

Amongst matters relating to food production, reference may be made to pigs, and to the making of pork, bacon, and other products. As is well known, the Imperial Department of Agriculture has long advocated the increased keeping of pigs in these islands, and the Commissioner has suggested that pig raising might well assume the character of a large staple industry. It should be quite possible to raise pigs in sufficient numbers to permit of the erection and working of bacon factories of quite considerable size, and the agriculture of the islands would be greatly stimulated thereby. There is an increased interest being taken in this question of pig raising, and it is to be hoped that it will receive serious and systematic attention. It is a business which has great potentialities, but it must be recognized that it is a business which needs knowledge, skill, and energy for its successful operation.

With an interest in pig raising one may also hope to see increased interest in other branches of animal industry. The raising of cattle is a business of some little importance, even for the production of the working cattle required for the estates; but it can hardly be said that the industry receives the skilled attention it deserves. So far as is evident, very little care is taken in the selection of animals for breeding. In this connexion it is interesting to refer to the great pains and expense incurred some six years ago by Messrs. Henckell, Du Buisson & Co., in the importation of four Indian cattle into Antigua. These cattle constitute an important addition to the breeding stock of that island, and, if intelligently used, their influence should extend beyond the island, and have a marked influence in neighbouring colonies. There are possibilities in this way of improving the general run of working cattle, but beyond that it should be possible to

build up from them a herd of pure-bred cattle for the permanent benefit of the West Indies. Recent investigations into stock-breeding problems seem to render this possible.

In connexion with stock raising, reference must be made to the benefits accruing from the adoption of dipping or spraying for the control of ticks. The health of the animals is thereby greatly improved and, incidentally, some diseases such as 'skin disease' are likely to be eradicated.

There are various indications of progress in agricultural matters in most of these islands, and signs that something is being done to secure that efficiency in production which alone will make agriculture sound and remunerative. Attention is being given to increased crop production as influenced by soil problems, by the nature of the crops grown, and by the animals employed in the industry. Much also has been done to improve the method of sugar manufacture. A substantial move has been made in the direction of mechanical haulage, including steam ploughing, motor ploughing, and the use of motor traction generally—a movement which is certain to progress rapidly in the near future. It would seem too, that it is becoming recognized that agriculture once more offers a useful career for young men of all classes, and that a larger number are being attracted to it than formerly; at the same time it is being recognized that the higher branches of the work require sound education and good training on the part of those concerned, and agricultural education is calculated to be stimulated thereby.

It is well to look for these signs of progress from time to time, and to endeavour to foster them by frankly discussing them. Such observation and discussion will tend to strengthen and confirm progress, and keep it on sound lines.

DEPARTMENT NEWS.

Mr. S. C. Harland, B Sc., Assistant for Cotton Research, provided by the Imperial Department of Agriculture and Scientific Research on the staff of the Imperial Department of Agriculture for the West Indies, left St. Vincent on December 27 for the purpose of research work on cotton in Montserrat, where he is expected to remain for about a month.

A NOTE ON THE INHERITANCE OF ANTHOCYANIN PIGMENTATION IN CASTOR BEAN CROSSES.

In a previous number of the *Agricultural News* (Vol. XVII, p. 416) it was pointed out by Mr. S. C. Harland that the presence and absence of 'bloom' in the castor bean appeared to form an allelomorphic pair. The cross under observation was one between a semi-wild type from St. Vincent and a variety known as *Ricinus Gibsoni*. The latter is characterized by a strong development of anthocyanin pigmentation in stem, leaf capsules, etc., and for this reason it is used extensively as an ornamental plant in gardens. The native type is not altogether devoid of colour, for the stem is distinctly tinged with pink, and the veins of the leaf are seen with a strong lens to contain a certain amount of pigment. The capsules, however, are green.

The F_1 of the cross between these two varieties was intermediate, inclining towards the green parent. The stem was strongly reddened, but the capsules were green.

Segregation took place in F_2, and classification was made into two groups, (a) capsules green, (b) capsules red, leaves more or less reddened, stem dark purple. If the capsules were green the rest of the plant was correspondingly less coloured. The plants were also examined for the presence and absence of bloom, with the following result:—

	Capsule green.		Capsule red.	
	Bloom present.	Bloom absent.	Bloom present.	Bloom absent.
	74	28	22	9
Expectation on 9: 3: 3: 1 basis				
	74·8	24·9	24·9	8·3

It will be seen that the above ratio is quite near to expectation on the assumption that the difference in the amount of pigmentation of the two parents is due to a single factor partially dominant to its absence, and inherited independently of the factor for bloom. It must be pointed out that there was a certain amount of variation in the double recessive class, and this possibly indicates that subsidiary factors may be concerned, having the effect of modifying the intensity of the pigmentation.

CONNEXION BETWEEN COLOUR OF SEED AND COLOUR OF CAPSULE.

The native parent had a seed of characteristic warm brown pattern, while the seed of *R. Gibsoni* had a pattern which was very dark brown, almost black in colour. The seeds of the F_1 were quite uniform, and different from those of either parent, being almost uniformly dark brown. It was noticed that the plants with red capsule contained no plants with seeds of the characteristic F_1 pigmentation. This seems to indicate that a genetic correlation exists between seed coat pattern and pigmentation of the vegetative parts. It is intended to make further observations on this point when the F_3 cultures are available.

GRENADA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1917-18.

This report, which has recently been issued, is one that shows considerable progress during the year under review. There was a marked increase in the number of plants and seeds distributed from the Botanic and Experiment Stations as compared with plant distribution in previous years, especially in regard to sugar-cane and sweet potato cuttings. The plot experiments with food crops carried on at the Botanic Station continue to be of interest. This is particularly the case as regards yams, concerning which special efforts continue to be made to encourage a more extensive cultivation. The experiments with onions also give promise of a local iudustry of some value resulting therefrom in the near future.

A very striking feature of the report is the account given of the results attending the Native Food Crops Campaign. Initiated by the Agricultural and Commercial Society, with the approval of the Government, this campaign was undertaken and carried out by the officers of the Agricultural Department in co-operation with District Boards, with the object of increasing the production of native food crops in view of the advancing cost and possible shortage of imported foodstuffs consequent on the war, and the scarcity of ground provisions locally. It entailed a considerable amount of work on the part of these officers, but met with abundant success, as may be gathered from the concluding paragraphs of the account, which are as follows:—

'The campaign has been an entire success throughout the planting season. The very satisfactory co-operative spirit which pervaded the entire community during this season, and the keen interest taken by planter and peasant alike in increasing production, are responsible for the very satisfactory position in native food production at the end of August 1917.

'It may be said that almost every available plot of land in the colony, suitable for the growing of provision crops, has been cultivated in quick-growing and early-producing food crops during this season.

'A very satisfactory feature of this planting season, without doubt due to the activities of the campaign, has been the considerable increase in tillage and draining performed in preparing the land for garden purposes.

'Several hundred acres of land previously held in reserve on many estates have been let to peasant gardeners during this season.'

As regards the staple crops of the island, it appears that cacao has produced the largest crop ever known, the exports for the year—77,275 bags of 180 lb. each, valued at £486,519 13*s.* 7*d.*—constituting a new record, and exceeding by 295 bags the previous record of 76,900 bags for the year ending September 30, 1916. The spice crop, while showing a decrease in quantity as compared with last season's record, was nevertheless satisfactory. The lime crop also showed a decrease as compared with the record for last year The Prize Holdings Competitions were again held, and, as in previous years, gave evidence of eventually becoming of great benefit to the agriculture of the island. In this connexion it may also be observed that the Land Settlement Scheme continues to be a success, satisfactory progress having been made on all the Settlement estates during the year, especially in the growing and cultivating of ground provisions.

This report bears further testimony to the efforts towards the continued improvement of agriculture in the colony put forward by the Officers of the Depart-ment, and the good results which attend them.

JAMAICA: REPORT ON THE DEPARTMENT OF AGRICULTURE, 1917-18.

For the third year in succession the island of Jamaica was visited by a hurricane, which again caused the general destruction of the banana fields. In certain sections of the eastern part of the island a heavy loss of coco-nut trees also resulted. This loss was even greater than appeared at first to be the case, for many hundreds of trees, which seemed to have withstood the storm so as to offer promise of recovery to health, have since fallen victims to various forms of parasitic diseases.

On the other hand, the sugar industry, stimulated by high prices, has established a modern record for sugar in Jamaica by an export of 32,000 tons in 1917. Although no practical projects for central factories have so far been established under the scheme proposed by Sir Francis Watts, Imperial Commissioner of Agriculture for the West Indies, for the financing of central factories by general revenue, still it is stated that three new factories have been erected in the irrigable area of the parish of St. Catherine. One of these is reported to be capable of dealing with 100 tons of sugar a day. In connexion with the revived interest in the sugar industry, it is to be noticed that there has been a great demand made to the Department for cane plants of superior varieties. It is said that the new, locally produced variety, J.72, has done remarkably well in some districts, and it is recommended for extended cultivation, especially by small settlers in wet districts. Experiments made with the Uba cane have shown it to be a very vigorous grower at the Hope Experiment Station, and although not likely to be of much use for the production of sugar in Jamaica, it will probably prove of considerable value if planted for fodder.

The coco-nut industry is rapidly assuming an important position among the industries of the colony. Including copra, equivalent to about 6,000,000 nuts, the exports of coco-nuts for 1917 were estimated at nearly 30,000,000 nuts. Had it not been for the hurricane of September this figure would have been decidedly higher. So many young trees, however, are now coming into bearing that the loss of many thousand bearing trees at the east end of the island will soon be made good, and Jamaica will probably show progressive development in coco-nut production. The manufacture of copra is a new business in the island, but planters have been securing good results in this matter. It has been found that the use of 1lb. of sulphur per 100lb. of copra, injected as fumes in the early stages of the drying of the copra, is effective in securing a high class copra, free from moulds and bacterial infection. The Jamaica coco-nut planters are right in striving to ensure the production of a first class copra, so that the Jamaican produce may be regarded in the markets of the world as of the highest grade.

The export of logwood fell to less than half of that of 1916, but logwood extracts kept up steadily, and brought up the total value of logwood and its products to the respectable sum of £540,000. Ginger and pimento each brought in about £70,000.

Owing to war conditions, the export of citrus fruits fell off considerably, but, as a set off to that, a remarkable demand sprung up for orange oil, and £47,000 was received for this product during the year under review. Unfortunately, with the growth of the industry, dishonesty has appeared in the form of adulteration by kerosene and cotton-seed oils. Active steps have been taken to check this evil. It may be mentioned that the detection of cotton-seed oil adulteration of orange oil is easily accomplished by the grease spot test on paper, so that buyers can test their oils by this simple means.

Honey has become under war conditions a lucrative product in Jamaica. The honey exported in 1917 was sold for £46,000, at an average of 5*s.* 6*d.* per gallon, three times the price of honey exported before the war. Bee keepers are reaping a profit they had scarcely hoped for.

The fibre plantation at Lititz has made great progress, there being at least 1,000,000 sisal plants now established at that station. Provision has been made for an extension of 300 acres during the current year, and it would seem that a lucrative industry has been started for that particularly dry district of the island. The conclusion come to in this experiment is that in poor soil plants do not make such robust growth as in more fertile soils, and therefore closer planting is advisable in poor soils. It is also stated that it is advisable to cultivate a small area round each plant in the field to break up the hard soil, and then to mulch this with grass. Plants so treated are greatly improved in vigour. The experiments at Lititz have corroborated the conclusions reached in East Africa that the planting of bulbils is much more satisfactory than the planting of suckers. In fact, the report under review states that if a plantation is kept in good condition no suckers will be allowed to grow, as they consume a great deal of nourishment, and their development impoverishes the parent plant, and causes it to pole prematurely.

The report includes a special report on the Government Stock Farm at Hope. This will be dealt with at more length in a future number. The Department of Agriculture in Jamaica is evidently doing useful work in many directions.

Vanilla Crop of Guadeloupe.—It is reported by the United States Consul at Gaudeloupe, according to the *Perfumery and Essential Oil Record*, September 1918, that the crop of vanilla which was harvested and cured during the first six months of 1918 proved to be the best that Guadeloupe had produced. The total exports of vanilla for the year 1916 were 69,401 lb., which fell in 1917 to 41,985 lb., whereas in the first six months of the present year no less than 69,652 lb. were exported to the United States alone. In spite of the exceptionally large crop, prices for both green and cured beans did not fall below those paid during 1917, the average prices for both years having been 4 francs per kilo for green, and 20 francs per kilo for well cured beans. Most of the exporters succeeded in shipping their produce before the United States War Trade Board prohibited the importation of vanilla from the West Indies, and it is probable that the total quantity of cured beans at present unshipped in Guadeloupe does not exceed 18,000 lb.

DECREASING SUPPLY OF CAMPHOR.

From very early times camphor has been held in high estimation, chiefly for medicinal and sanitary purposes. In recent years it has been increasingly used industrially, particularly for the production of celluloid. The supply, however, has by no means kept pace with the demand. In several recent issues of the *Perfumery and Essential Oil Record*, attention has been directed to the increasing difficulty in obtaining supplies of raw camphor for refineries in the United Kingdom. This deficiency appears undoubtedly to be due to two causes, which, acting together, are gradually shutting out the crude article from importation both into the United Kingdom and into the United States. In the first place, there is the very natural desire of the Japanese to export the finished article rather than the crude material for British and American factories to refine. Secondly, when it is remembered that most of the camphor in the world's market comes from Formosa, the marked decrease in the productiveness of the camphor forests there must needs tend to a deficiency in the supply of the product. The progressive exhaustion of the camphor trees in the readily accessible districts of that great Eastern island, coupled with the savage nature of its interior and its inhabitants, renders the problem of keeping up the supply of camphor an extremely difficult one. When it is remembered that comparatively little has been done in the way of new plantations to replace the wild trees which are disappearing, it is not likely that the situation will become easier in the near future. It appears also that conditions in the Chinese camphor districts are more or less the same as to the progressive exhaustion of the trees Not only are the shipments of crude camphor to the United States becoming smaller and smaller, but the refined coming in is much less than enough to meet the demand. In Japan also, an extreme scarcity of supply is felt, so much so that a government commission has been appointed to endeavour to increase camphor production in the Taiwan district, through personal inspection and supervision of camphor plants there. The greatest trouble now being experienced in Japan is the scarcity of labour, and the preference on the part of growers to raise other crops.

Of course, the shortage of supply has been accompanied by considerably higher prices, camphor oil being quoted: brown, 160*s.* to 170*s.* per cwt.; and white, as much as 175*s.* to 200*s.*; and yet the refiners are often unable to obtain any quantity even at these rates.

It is suggested in the journal referred to above that there might be a hopeful outlook commercially for planters in some of the tropical countries to experiment in the acclimatization of the camphor tree (*Cinnamomum Camphora*). It is not merely a question of whether the trade shall or shall not become a complete monopoly of Japan, but the even more important question of ensuring that sufficient camphor for the world's requirement is forthcoming.

It must be remembered in this connexion that, as was pointed out in the *Agricultural News*, Vol. XVI, pp. 179 and 317, there are at least two distinct varietal types of the camphor tree, one of which only yields oil from which no solid camphor is obtainable. It is suggested that in establishing a camphor plantation great care should be taken in planting only seeds from trees well known to produce solid camphor, or to propagate this desirable variety by cuttings. As far as is known at present, no camphor tree growing in the West Indies produces anything but the oil.

DEMERARA SUGAR-CANE MANURIAL EXPERIMENTS IN 1917.

Professor J. B. Harrison, C.M.G., Director of Agriculture, and Mr. R. Ward, Agricultural Superintendent, contribute an interesting paper on the above subject to the *Journal of the Board of Agriculture of British Guiana*, October 1918. These experiments were carried out on the experimental fields of the Board of Agriculture, Botanic Gardens, where the rainfall for the year was 92·22 inches.

One half of the south field, after lying fallow from cane cultivation for two years, was placed under cultivation in June 1916. At the commencement of the fallow period Bengal beans (*Stizolobium aterrimum*) were sown throughout the field; the beans however did not spring well, nor did they produce a satisfactory cover, and the land was purposely allowed to become covered with a spontaneously growing mixed herbage consisting largely of indigenous or naturalized leguminous plants. The herbage was cut and forked in twice each year during the period the land remained fallow. Thirteen varieties of Demerara seedlings were planted in the fields. A table is given of the average yield of these varieties in tons of cane and of indicated sugar per acre, together with the average gravity and purity of the expressed juice. From this table it appears that D.118 takes the first place, with an average yield of 33·1 tons of cane per acre, and an indicated yield of sugar per acre of 3·78 tons.

The plots were either unmanured, or received 40 lb. or 60 lb. of nitrogen per acre in the form of sulphate of ammonia.

As a rule the increased manuring with sulphate of ammonia did not result favourably, although the lower application gave a comparatively large increase both in tons of cane and indicated sugar per acre. It is suggested that this was doubtless due to prevalent weather conditions, the period of actual growth not being long enough to allow of the complete utilization of the larger quantities of the manure.

Alternate half-plots of this variety were dressed with superphosphate of lime. The results given in tabular form show that the mean gain by the application of superphosphate of lime to plots not manured with sulphate of ammonia was 1·7 tons of cane per acre, whilst on plots manured with sulphate of ammonia as well it was 1·1 ton. It is not considered that, at the usual price of superphosphate of lime, the increase due to the manuring would pay the cost of the application.

Owing to the increasing scarcity of sulphate of ammonia, it is necessary for cane planters to seek for other sources of nitrogen. For this purpose experiments were made in mulching plots heavily with rice straw, large quantities of which are readily available in British Guiana. It was considered that such applications of the straw would conduce to beneficial effects for three reasons: (1) because of its direct manurial action by the addition of nitrogen, phosphoric acid, lime and potash to the soil; (2) because of its action in preventing the development of weeds, especially grasses; (3) by the large amount of woody fibre not immediately decomposable added to the soil, which would gradually render the surface soil lighter, and hence of better tilth.

With regard to the first reason, it is computed that an application of 12 tons of rice straw per acre adds to the soil the following quantities of the more important constituents of plant food: nitrogen, from 70 lb. to 94 lb.; phosphoric anyhdride, 32 lb.; potash, from 214 lb. to 231 lb.; lime, from 32 lb. to 38 lb.

With regard to the second reason, the surface dressings of rice straw have a marked effect in keeping down the growth of weeds, if the straw is spread fairly thickly over the land in which are young canes, or before planting it in canes. In the experiments the plots dressed with rice straw remained comparatively free from weeds, especially grasses, while plots not receiving any straw dressing became covered with a thick growth of such weeds.

The third benefit will tend to increase after the land has received several dressings of the straw. The result of experiments with three varieties showed an average increase of cane per acre of 2·8 tons on plots treated with 25,000 lb. of rice straw per acre over those receiving no rice straw. It is stated, therefore, that from the results of this first year's comparative trials, it is evident that it is worth the while of sugar planters in British Guiana to make large scale trials with any rice straw which may be available, remembering always that the full advantage of mulching with rice straw will not be apparent until repeated for several crops.

Professor Harrison has pointed out on several occasions that although the soils in British Guiana are extremely rich in potash, there is always a possibility that sugar-cane cultivation long continued without any break may result in the readily available potash of the soil being the first soil constituent to show signs of commencing depletion. A series of plots was arranged to be manured with sulphate of potash at the rate of 150 lb. per acre in addition to the usual nitrogenous manuring.

From the tables given as to the results of this experiment, it would appear that the gains due to the application of sulphate of potash in the above amount per acre were 2·6 tons of cane per acre, and ·42 per cent. of saccharose.

These results indicate that when the supply of immediately available potash in the soil has become somewhat depleted, the nitrogenous dressings, as well as the readily available nitrogen of the soil, cannot exert their full effect unless aided by applications of potash salts.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST LUCIA. During the month of November plant distribution included the following: lime plants, 2,500; grafted mango, 2; budded orange, 41; grape fruit, 6; decorative and ornamental plants, 39; cassava cuttings, 60,000; potato cuttings, 20,000; also 80 packets of vegetable seeds. Regarding staple crops, Mr. Brooks, the Agricultural Superintendent, mentions that the reaping of the cacao and lime crops continues, while that of the sugar crop has commenced. A leaflet containing notes on drainage was issued for general distribution, while one giving notes on the general improvement of cacao plantations in St Lucia is now in the press. Both of these were prepared by the Agricultural Superintendent. The rainfall during the month recorded at the Botanic Gardens, Castries, was 4·82 inches; the record at the Agricultural and Botanic Station, Choiseul, was 4·24 inches.

ANTIGUA. According to notes of interest forwarded by Mr. T. Jackson, Superintendent of Agriculture, plant distribution during the month of November included the following: bay plants, 898; coco-nut, 103; lime plants, 66; miscellaneous decorative, 59. The cane crop continues to improve, and the preparation of land for next year's cane crop is well under way. The reaping of the cotton crop is in full swing

Regarding this, the opinion is expressed that normal returns will be obtained. During the month severe attacks of cotton caterpillars were experienced, which completely defoliated the plants in some parts of the island. The flower-bud maggot of cotton was also noticed during the month. The amount of seed-cotton purchased during the month was 9,553 lb.; the quantity purchased to date is 17,439 lb. During the month Sir Francis Watts addressed a meeting of the Agricultural and Commercial Society, also a meeting of the Antigua Cotton Growers' Association. The rainfall recorded at the Station for the month was 7·17 inches; for the year 38·48.

In a brief report on agricultural instruction, attacks of cotton caterpillars on the holdings visited by the Agricultural Instructor during the month are recorded. These were being kept in check by repeated dustings of Paris green and lime, or London purple and lime. Dusting with ashes has also been tried by the peasants, but although the worms are killed the ashes do not adhere to the leaves. This cannot, therefore, take the place of Paris green.

ST. KITTS. During the month of November 87 lb. of peas of various kinds were distributed from the Botanic Station, where work of a routine nature was carried on Regarding staple crops, Mr. F. R. Shepherd, the Agricultural Superintendent, states that the cane crop throughout the island has considerably improved during the past month, and if the rains continue, the prospects for the coming season will be decidedly better. The canes look green, vigorous, and healthy, and in the northern district the returns will be above the average of the past two seasons. A few of the muscovado estates are reaping their 'stand over' canes, and making syrup, which is fetching a good price. It seems likely that these estates will go in for syrup making to a large extent in the coming season. The young cane crop is being planted, and the germination appears to be good. The old cotton plants are being rapidly turned in on the estates in the northern district; the close season takes effect on December 15. The yield per acre has been above the average for this district. In the valley district picking still continues, but the heavy rains have caused much loss of bolls, and the great prevalence of the cotton stainer will render the second picking of little value. Visits were paid during the month to the estates round the island in connexion with sugar-cane experiments, and the campaign against the native food-plants of the cotton stainer. All owners of estates have agreed to destroy these plants growing on or about their properties, and the Ordinance will soon be in general operation. The total rainfall for the month was 9·87 inches; for the year to date, 44·65 inches.

DOMINICA. The Curator, Mr. Joseph Jones, writes to say that the crop reaped from the lime experiment station during the month of November was 103 barrels, making a total to date of 797 barrels of limes. Plant distribution during the month was as follows: lime plants, 2,775; budded citrus, 48; grafted mango, 4; nutmeg, 2; miscellaneous plants, 16. In addition, 3,500 shade tree cuttings, and 800 cane cuttings were sent out, and 235 packets of vegetable seeds sold. The local market price for fresh raw lime juice has fallen from 8*d.* to 6*d.* per gallon, and that for ripe limes from 4*s.* to 3*s.* 6*d.* per barrel. Mr. C. A. Gomez was appointed to act as Assistant Curator, and took up his duties on November 28. Dry weather prevailed during the month, the rainfall recorded being 3·36 inches.

MONTSERRAT. In items of interest for the month of November, Mr. W. Robson states that the rainfall continued to be satisfactory for the development of crops in the Experiment Station. Considerable trouble has been experienced with the caterpillar (*Prodenia* sp.) on the ajowan plot. Plant distribution included: lime plants, 3,250; bay plants, 1,580; cane cuttings, 340; sweet potato cuttings, 800; cassava cuttings, 100; various beans, 22 packets. The second crop of cotton in the Station is turning out fairly well. Samples of seed-cotton were selected for further inquiry into the question of the suppression of lint length in second crop pickings. Generally the weather has been favourable for the development of the second crop of cotton, and the ultimate result from the crop will probably be up to the average of previous years. Of the 1918 crop, 859 bales have been delivered to the Government. Attacks of cotton worm have been particularly severe on the second growth, and on large areas the plants have been completely defoliated. An experiment is being conducted on one estate as to the advantage of pulling out alternate rows of cotton when the second growth is abnormally vigorous. On certain areas, and in many cases where there was a prospect of good second pickings, cotton stainers have become unduly numerous, and in this respect—taking the island as a whole—are perhaps a month ahead of the time of their occurrence in previous years. The destruction of mahoe trees was proceeded with. A large crop of limes is developing on the areas which produced a poor crop earlier in the season. The rainfall registered at Grove Station during the month was 5·20 inches, and was well distributed; the total rainfall for the year to date is 50·37 inches.

NEVIS. The Agricultural Instructor, Mr. W. I. Howell, writes to say that during the month of November the plots in the Experiment Stations have all been kept in good order. Cotton plots have suffered much on account of the heavy rains, which caused boll dropping and black bolls. The sugar-cane crop throughout the island has very much improved since the rains. All the fields have made very good growth, and a fairly good crop is expected. Preparation for next season's crop is in progress, and planting has begun in some places. Syrup for local consumption was made on small estates. The continuous rains, coupled with the very severe attack of cotton stainers, have shattered all hopes of anything like an average second picking anywhere; poor yields were obtained from all the late fields. An Act providing for a close season, and one providing for the destruction of native food-plants of the cotton stainer were recently passed, and will soon be put into operation. The provision crops are all doing well, and a good crop of yams and sweet potatoes is expected. The quantity of new crop cotton purchased for the Imperial Government up to the end of November is 413 bales, 377 of which were from cotton grown in Nevis. The rainfall recorded for the month was 10·98 inches; for the year to date the record is 51·70 inches.

Citrus Hybridization.—The *Journal of Heredity*, October 1918, states that in the spring of 1914 extensive hybridization of citrus fruits was begun at Riverside, California. Crosses have been made between the varieties of orange, lemon, pomelo, and mandarines (tangerines), besides a few crosses of bergamot orange. These crosses are partly within botanical species, for instance, between Valencia orange and the Mediterranean Sweet orange; many, however, are between different species as between the Dancy tangerine and the Marsh pomelo. Some of these crosses have already proved to be of considerable interest, and there will doubtless be produced in the future varieties possessing one or all of the desirable characteristics of hardiness, productiveness, and flavour, which may render them of great commercial importance.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

SCIENTIFIC STAFF.

Scientific Assistant and Assistant Editor	W. R. Dunlop.* Rev. C. H. Branch, B.A.
Entomologist	H. A. Ballou, M.Sc.
Mycologist	W. Nowell, D.I.C.
Assistant for Cotton Research	S. C. Harland, B.Sc.†

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Assistant for Publications	A. B. Price, Fell. Journ. Inst.

*Seconded for Military Service.
†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial is the conclusion of Sir Francis Watts's address to the Antigua Agricultural and Commercial Society on the subject of efficiency in production, the first part of which appeared in the previous number of this Journal.

Insect Notes on page 410 conclude the summary of the entomological information published by the Department during 1918.

Some other diseases of coco-nut palms in Grenada, are the subject of the article under Plant Diseases on page 414.

Some recent activities of the Jamaica Imperial Association are noticed on page 415.

The Barbados Agricultural and Industrial Exhibition

The annual exhibition under the auspices of the Barbados General Agricultural Society was held on December 18, at Queen's Park. The weather was all that could be desired, and the attendance, it is said, constituted a record.

As far as the quality of the exhibits is concerned the exhibition may be pronounced a success, but as regards the number and variety of them it must be said that, considering the fact that Barbados is pre-eminently an agricultural community, more might have been expected. From the attendance it is plain that the general public takes great interest in this exhibition, but the agriculturists of Barbados seem to need some awakening to a sense of appreciation of the advantages to be derived from taking part in agricultural competitions.

The exhibits of canes, although individually good, could hardly be said to be representative of Barbados cane cultivation. The exhibits of vegetables and fruit presented fine specimens in the various classes, but considering the favourable weather conditions of the past year, a larger and more varied collection was to be expected.

As regards live stock, the ponies exhibited, although few in number, were very attractive. One feature of this section as compared with last year's was the good show of splendid donkeys, the improvement produced by the services of the lately imported jacks. The cattle, sheep, and hogs were up to the usual standard. As to the poultry and rabbits, the number of empty coops seem to indicate either a falling off of interest in the production of such stock, or a lack of public spirit in the exhibition of them. It is quite true, however, that individual pens presented first class samples of various breeds of poultry. The exhibit of goats was most praiseworthy; a separate notice of this will be found elsewhere in these columns.

There was the usual attractive display of native confectionery and pickles, and other minor industries of the island. The art section was displayed to much greater effect than usual, and was of considerable interest and excellence.

One of the most striking displays of the exhibition on its industrial side was that of the cabinet makers. The specimens of furniture shown, of local manufacture and chiefly of local woods, would stand comparison with work of that kind in any part of the world.

A new feature of this exhibition was an exhibit of motor trucks, which attracted considerable attention from the public in general and from planters especially. There can be no doubt that motor traction will be increasingly employed in the island. We must however issue a note of warning that, in consideration of the narrow roads, it may be well to limit very strictly the width of loads on such trucks.

The Barbados Goat Society.

The eighth annual show of the above Society was held on December 18, 1918, in connexion with the

General Agricultural and Industrial Exhibition at Queen's Park.

The Barbados Goat Society is to be congratulated on the evident success of the efforts to improve the breed of goats in Barbados. The exhibits at this show would seem to be of an unusually high class, both as regards the milch goats of some age, and those which had produced only one litter of kids.

In Class I, of ten exhibits consisting of goats which had produced more than one litter of kids, the champion milker was 'Ann'. This goat, after 292 days of milk production, yielded 4·5 lb. of milk when milked at the show, her last milking having been at 5 o'clock on the previous evening. The first prize, and a Diploma of Merit were awarded to the owner of this goat by the Imperial Commissioner of Agriculture for the West Indies. In the second class, of goats having had but one litter of kids, the first prize was awarded to 'Springhead', who after 294 days of milk production gave 3·10 lb. milk at the show under the same conditions as in Class I. In Class III of doe kids, among the twenty exhibits there were some remarkably fine specimens, the first prize going to 'Enfield Sina'. Class IV, bucks, contained only four exhibits, two of which received prizes given by the Barbados Agricultural Society.

The goats shown in many cases seemed to be pure bred Saanen or Toggenburg, though probably a large number were not quite pure, being the results of crosses with native goats, and in some instances certainly, having an admixture of the Anglo-Nubian strain.

Biologia Centrali-Americana.

During the nineteenth century a number of scientific surveys of countries, and scientific voyages were undertaken by various European governments, which have added greatly to the world's knowledge of zoology, botany and archaeology. Most of these publications were produced, altogether or in part, at the expense of various European governments who were able to enlist the co-operation of the most eminent scientific men. Perhaps, however, the most comprehensive and beautifully executed work of this class is the 'Biologia Centrali-Americana', which was initiated and completely carried out by the authors, Dr. F. Ducane Godman and Mr. Osbert Salvin, two eminent English naturalists, at their own expense, between the years 1879-1915. Its sub-title is the modest one of 'Contributions to the Knowledge of the Fauna and Flora of Mexico and Central America'. It describes the antiquities, flora, and fauna of the whole of Mexico and Central America as far as the southern boundary of Panama. The work consists of sixty-three volumes, containing 1,677 plates, of which more than 900 are coloured. The total number of species described is 50,263, of which 19,263 are described for the first time. It was privately issued, and has therefore remained for the most part unknown to the general public. After Mr. Salvin's death in 1898, Dr. Godman completed the book, and has recently sold the remainder sets of this monumental work to Bernard Quaritch, Ltd., to be disposed of commercially.

The Influence of Sun Spots on Climate and Plant Activity.

Variation in solar radiations should be followed by variation in terrestrial climatic conditions. Meteorologists have long looked to variation in the number of sun spots as a possible factor underlying variation in climatic factors.

If such climatic factors as heat and rainfall be related to the number of sun spots, these should be a factor of importance in plant growth. From a review of recent literature on this subject in the *American Naturalist*, December 1917, it would appear that Dr. J. Arthur Harris considers that the results of recent investigations are directly opposed to the theories which seem to have prevailed among many writers.

In the first place, the relationship between the number of sun spots and the annual record of terrestrial meteorological phenomena is very slender indeed.

In the second place, with regard to rainfall and barometric pressure the correlation between these and the number of sun spots is especially low.

In the third place, the correlation between number of sun spots and terrestrial temperature is the more consistent and substantial. It is remarkable, however, that the years of larger numbers of sun spots seem to be, in the long run, years of lower, not higher terrestrial temperature.

The British Guiana Sugar Crop, 1917-18.

In a note which appears in the *Journal of the Board of Agriculture of British Guiana*, October 1918, Professor Harrison, C.M.G., Director of Agriculture, and Mr. Robert Ward, Agricultural Superintendent, state that the total area in sugar-cane cultivation in the colony during 1917 was 78,346 acres, an increase of 2,602 acres over the area occupied by that crop in 1916. For the crop of 1918, 77,823 acres are under canes, being 518 acres less than in 1917.

By far the most widely grown cane is D.625, no less than 36,000 acres being planted under this variety for the present year. It is to be noticed that a considerable area—4,950 acres—is still planted with the old Bourbon. Returns supplied by the sugar plantations give the following percentage of the crop of 1918: Demerara varieties, 79·5 per cent.; Bourbon and other old varieties, 13 per cent.; Barbados varieties, 6·7 per cent.; Java varieties, 8 per cent.

From the returns supplied by the managers of the sugar plantations, as to the average yield in tons of commercial sugar per acre of the principal varieties under cultivation for the crop of 1917, it appears that the variety D.419 headed the list with a return of 2·15 tons per acre.

The results of large scale field trials with other varieties show that at least seven of the Demerara seedlings indicate a yield of 3 tons or more per acre.

SUMMARY OF ENTOMOLOGICAL INFORMATION DURING 1918.

(*Concluded.*)

Moth borers of sugar-cane in Mauritius. Bulletin No. 5 of the Mauritius Department of Agriculture gave an account of the moth borers, four in number, of sugar-cane in that island. This bulletin was reviewed at page 26.

Cotton. The insect notes dealing with insect pests of cotton during the year were as follows: 'Cotton Stainer Control in St. Vincent', p. 266; 'The Spread of the Mexican Cotton Boll Weevil in the United States,' p. 298; and 'Cotton Insects in Arizona', p. 330. A note on machines for the treatment of cotton seed for destruction of the pink boll worm in Egypt appeared on page 40. Cotton seed from Para, infested with the pink boll worm, arrived at Barbados, and the cargo was prohibited from landing. This was dealt with in a note on page 376. An account of the recently passed Ordinances relating to cotton pests will be found on page 391.

Sweet potatoes. Articles in which accounts are given of insects attacking sweet potatoes appeared at pages 42 and 346. The first of these was entitled 'The Sweet Potato Root Weevil'. The second includes two notes: one on weevils attacking sweet potatoes and yams, and the other on termite injury to sweet potatoes. A note on page 69 refers to the prohibition of the importation of sweet potatoes and yams into the United States from January 1, 1918. This action was taken to prevent the further importation into that country of the sweet potato root weevil and the scarabee of the sweet potato.

Indian corn. The control of corn caterpillars including the corn ear worm, the cotton boll worm, and the moth borer of the sugar-cane, all of which have attacked corn in St. Vincent, are the subjects of the insect notes at page 218. The use of starch instead of lime as a carrier for arsenical poisons is dealt with at some length in these notes, and successful results reported from St. Lucia and St. Vincent.

Mole cricket. The West Indian mole cricket or 'changa' formed the subject of two insect notes on pages 106 and 122, being a review of *Bulletin 23* of the Porto Rico Agricultural Experiment Station.

Locusts. The insect notes at page 202, entitled 'The South American Locust in British Guiana', give an account of the invasion of the North West District, British Guiana, by a huge swarm of locusts from Venezuela.

Jack Spaniards. A note on the establishment and spread of the Jack Spaniard (*Polistes annularis*) in Montserrat, into which island this insect was introduced in 1910, was given on page 279.

Red spider. The notes on the red spider (*Tetranychus telarius*), on page 90, give an account of this troublesome mite, and the four best spray mixtures out of a list of seventy-five tried. These were: (1) potassium sulphite, (2) lime sulphur, (3) kerosene emulsion, and (4) flour paste. Another mite pest well known in the West Indies is that which causes the disease known as scaly leg of fowls. A note on page 297 gives methods of treating this disease.

Parasites of hard back grubs. The insect notes on page 250 entitled 'Feeding Habits of the Parasites of Hard Back Grubs', give an account of the accidental circumstance which seems to have been vital to to the success of establishing *Tiphia parallela* in Mauritius. This insect is a parasite of the grub of the brown hard back which has been such serious pest in that island. Another reference to the occurrence of hard back grubs, and their control by pigs is to be found at page 328.

Fleas. Two articles on fleas and their control appeared at pages 122 and 138. These give accounts of several kinds of fleas, aud recommend measures for their control. A note on the use of Paranaph for the destruction of fleas is given at page 217, under the heading 'An Efficient, Quick, and Safe Insecticide'

Mosquitoes and malaria. The insect notes at page 43 present an account abstracted from the *Rhodesia Agricultural Journal*, October 1917, which discusses the increased knowledge with regard to the nature of malaria and the method of its transmission, and recommends measures for the prevention of malaria. In a note on page 233, the question 'Are mosquitoes of non-marshy districts capable of transmitting malaria?' is discussed.

Mosquito control. An article on mosquito control, which appears in two numbers of the *Agricultural News*, at pages 374 and 388, reproduces a lecture by Dr. Pierce, the leader of the class for the study of the entomology of disease, hygiene, and sanitation at Washington. This gives a good account of the various operations involved in systematic mosquito control, as applied to the neighbourhood camps, of towns, and villages, and the treatment of swamps, margins of ponds and lakes, and coastal bays and indentations.

The class for the study of the entomology of hygiene and sanitation was formed in May 1918 by members of the Staff of the Bureau of Entomology of the United States Department of Agriculture, with the idea that men would be required for the sanitary work in connexion with the control of disease-transmitting insects (see page 234).

The value of zoology to human welfare. This is the subject of the insect notes at pages 154 and 170. It is taken from an account in *Science*, of speeches by Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington, and by Dr. H. M. Smith, of the Bureau of Fisheries, at the meeting of the American Association for the Advancement of Science at Pittsburg, December 1917. Dr. Howard touched on the many ways in which insects affect the welfare of man, and Dr. Smith referred to the many zoological problems to be met and solved in the proper administration of work in connexion with the conservation and protection of the food fishes of the coast and lakes of the United States.

The production of light in certain animals. The notes dealing with this subject appeared in two parts: the first in the last number of Volume XVI, and the second at page 10 of the present Volume. These notes refer to light production on the part of animals of different groups, but it is pointed out that it is among insects that this phenomenon is developed to the greatest extent.

A note regarding the necessity for avoiding the introduction of insect pests was presented on page 56. Some 3,000 insects recognized as pests in other countries, not yet known to occur in the United States, might at any time be imported.

Quassia extract as a contact insecticide is dealt with on page 74. The conclusion reached was that, although valuable for certain insects, it is uncertain in its action, and too expensive to become a general insecticide for all aphides.

The production of beeswax in British East Africa is the subject of a note on page 91, giving a brief account of the collection and preparation of beeswax from the wild hives in the country.

H. A. B.

PLANTS POISONOUS TO STOCK.

Recently in Barbados very serious losses of valuable goats have occurred in the flock of one of the most prominent members of the Barbados Goat Society. In response to his invitation the writer of this note went over the grass fields from which he cut his fodder, to see if there were any plants mingled with the grass to the poisonous effects of which the death of his valuable goats could be attributed.

The grass was very much inter-penetrated with a growth of *Teramnus uncinatus*, a legminous plant, known in Barbados as 'Burn mouth', in some of the Northern Islands as 'Wis'. This is a climbing plant, with trifoliate leaves, and inconspicuous, small, yellowish-white papilionaceous flowers, producing slender black beans, about $1\frac{1}{2}$ inches long, covered with a white down. The writer of this note, from his own experience as a rabbit keeper, has found that in Antigua this plant, if fed to rabbits, even in small quantities, is fatal to them. On the other hand, it is asserted on excellent authority, that goats and sheep can feed on it with impunity.

A few days ago, however, the gentleman referred to above sent to the Imperial Department of Agriculture for the West Indies a specimen of a weed which he had found growing on his land, and which has a bad reputation. This has been identified as *Spigelia anthelmia*, a weed widely distributed in the Lesser Antilles from St. Croix to Grenada. In the Northern Islands it is known as 'Worm-weed'; in the islands where French is spoken it goes by the name of 'Brinvillier', evidently in allusion to the Marquise of the 18th century, of notoriety as a poisoner; in Barbados it seems to be called 'Water weed', probably because it is chiefly found in damp localities.

This plant has long been used by the natives of the West Indies as a very effective vermifuge, and that this is certainly its effect is shown, not only by its botanic specific name, but also by the fact that another of the same genus (*S. marilandica*). is quoted in the Pharmacopœas both of Great Britain and the United States as official for that purpose.

S. anthelmia is, however, a dangerous poison when administered in large doses, as the following extract translated from *Flore Phanerogamique des Antilles Francaises* by Reverend Father Duss, will show:—

'This plant is better classed among the Loganiacae along with the genus to which it belongs. The root is employed as a vermifuge against intestinal worms. In large doses it is a violent poison. The plant contains, according to Dudley, a volatile alkaloid (spigeline) which is the active poisonous principle, and which possesses close affinities with nicotine and lobelline—well-known poisons. It should be employed medicinally with the greatest care, on account of its toxic properties, although it is certainly a good vermifuge.'

The *British Pharmaceutical Codex*, 1911, also has the warning about spigelia that 'it is said to depress the circulation and respiration, and cause loss of muscular power when given in large doses. The drug is anthelmintic, and is used to expel round worms; it is said to be safe and efficient if given in proper doses, followed by a saline purgative.'

Now, whether the goats referred to above succumbed to a dose of this poisonous weed can only be determined by a careful analysis of the contents of their stomachs. And even then, it is very difficult to determine by *post-mortem* analysis of stomachs the exact vegetable poison to which death may be attributed.

One point may be noted: that goats and all other grazing animals seldom eat any poisonous plant, if left to graze at will, unless driven to do so by hunger, from lack of nutritious fodder. On the other hand, when such animals are chiefly fed by cut forage administered to them, they do not exercise so much discrimination. Too much care, therefore, can not be taken in seeing that fodder placed before animals fed in confinement is freed from all possibly noxious plants.

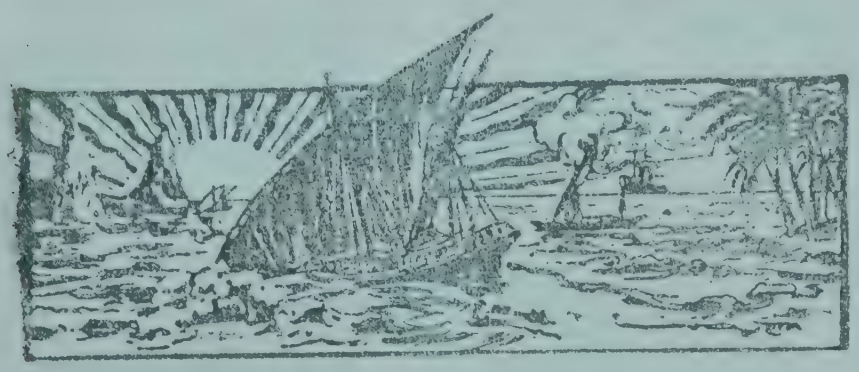
C.H.B.

AJOWAN SEED AND THYMOL.

Attention is drawn in the *Perfumery and Essential Oil Record*, September 24, 1918, to the great saving in transport charges which would be effected by distilling aromatic plants in the countries where they are cultivated, and exporting the oils rather than the raw material.

As has been pointed out in recent issues of this Journal, and also in other publications of this Department, experiments have been tried in the cultivation of ajowan (*Carum copticum*) in several of these islands, especially in Montserrat. This plant, which before the war was grown on a commercial scale mainly in India, whence the seeds were exported chiefly to Germany, is the principal source of the antiseptic thymol, largely employed in the treatment of hookworm disease. This is extracted from the oil distilled from the seed. During the last few years the plant has been experimentally grown not only in the West Indies, but in the Seychelles. Samples of seeds from plants cultivated in the Seychelles and Montserrat have been examined in the laboratories of the Imperial Institute, and the results of the investigation published in the *Bulletin of the Imperial Institute*, Vol. XVI, No. 1. Compared with the Indian product, the following results were obtained: oil yield, Indian seed, 3 to 4, per cent. Seychelles, 9 per cent.; Montserrat, 3·1 per cent. On the other hand, the Indian oil contained 40 to 55 per cent. of thymol; that from the Seychelles, 38 per cent.; and that from Montserrat, 54 per cent. The seed from Montserrat was submitted for valuation to three firms of manufacturing chemists. One firm stated that under the present abnormal conditions, ajowan seed oil containing about 50 per cent. of thymol would probably realize not less than 10*s.* per ℔., but they were of opinion that it would probably be essential to undertake the distillation of the seed locally, as the heavy freight charges on the seed, if shipped to Europe, would make competition with Indian thymol impossible. The opinion of a second firm coroborated that of the first, viz. that it would be more economical to distil the oil locally than to export the seed. The third firm also considered that the percentage of thymol in the oil from Montserrat seed was satisfactory, but in view of the difficulties of freight, aud the competition of thyme oil from Spain as a source of thymol, it would be better, if the distillation of the seed could be carried out economically in Montserrat, to export the oil rather than the seed.

The results of this examination of the Montserrat ajowan seed, together with the market reports on its value, appear to indicate that the plant could be successfully cultivated in that island as a source of thymol. The actual yield of ajowan seed per acre in countries where it is already grown does not appear to be on record, so that comparisons on this point are not possible. The *Perfumery and Essential Oil Record* quoted above gives the price of thyme oil on the London market as from 7*s.* 6*d.* to 8*s.* per ℔., and the price of thymol crystals at from 47*s.* 6*d.* to 50*s.* per ℔. It might be possible in Montserrat, if the cultivation of ajowan proves satisfactory, to combine the distillation of the oil with the present bay oil industry.



GLEANINGS.

A new tree, known as 'wild pimento', has recently been discovered by the Government Botanist, Mr. W. Harris, F.L.S., in the interior limestone mountains of Jamaica. It grows to a height of 40 feet or more with a trunk 1 foot in diameter. The leaves yield by distillation a very pleasant essential oil which is quite different from that of pimento or of the West Indian bay tree.

The report on the crops of Assam, for the year 1917-18, by the Director of the Department of Agriculture, states that the area under cotton was estimated for the season at 34,091 acres against 32,290 acres in the previous season. The people have extended their cultivation in cotton on account of the high prices obtained. The cotton grown in Assam is usually sold, curiously, as an adulterant of wool.

It is reported in the Jamaica *Gleaner*, October 21, 1918, that there is a project of erecting machinery in that island for the purpose of making banana figs. If the support of the banana planters of the Rio Nuevo district could be assured, it would be likely that all small fruit which the shipping companies do not handle would be disposed of at a fair price.

In the report of the Surgeon-General, British Guiana, for the year 1917, it is noted that at the bakery of the Lunatic Asylum in that colony special efforts were made to use substitutes for wheat flour, in view of the rapidly rising price of this article and the possible difficulty of obtaining any at all. Both rice flour and cassava meal were found quite suitable for replacing from 25 to 30 per cent. of wheat flour in the bread.

This year, Central Delicias, in the Oriente Province of Cuba, established a world's record for sugar-cane production at a single mill, the crop having been 615,360 bags of sugar. The previous record was held by Central Chaparra in the same province and belonging to the same company as Central Delicias; this was 613,000 bags of sugar made during the crop of 1915-16. (The *Louisiana Planter* November 9, 1918.)

The extraordinarily liberal scale on which the American Government subsidizes agricultural education and research is shown by the following figures which deserve notice. The expenditure of the United States Department of Agriculture has risen from £234,000 in 1890 to upwards of £5,000,000 in 1916, a figure which may be contrasted with the £300 000 odd expended by the English Board of Agriculture in the latter year. (*Nature*, September 19, 1918.)

According to the entomologist at the Experiment Station of the Hawaiian Sugar Planters' Association, good results are being obtained in the campaign against field cockroaches by the use of a wasp imported from the Philippines into the Hawaiian Islands a year ago. Only a dozen pairs of specimens survived the trip across the Pacific. These were released, and are multiplying rapidly. The wasp attacks young cockroaches and kills them. (The *Louisiana Planter*, November 2, 1918.)

The banana industry, which is the mainstay of the population in the Province of Limon, Costa Rica, has been decadent for several years, chiefly on account of the spread of the disease known as the 'Panama banana disease'. The reduction in the export of this fruit, owing to decreased shipping facilities, has accentuated economic distress in the Province. Large numbers of British West Indians are leaving for Cuba and other parts where conditions are better than they are at Limon. (*The Board of Trade Journal*, October 24, 1918.)

An article in the *Weekly Bulletin* of the Department of Trade and Commerce Canada, October 7, 1918, points out that in the five years, 1914-18, the present production of cane sugar has increased from 9,854,941 tons to 13,572,711 tons, while the production of beet sugar has decreased from 8,216,922 tons to 3,422,000 tons, making a decreased production for the world's output of sugar of both kinds of over 2,000,000 tons It is also noted that Cuba, with an output of 3,350,000 tons of cane sugar in 1918, produced one-fifth of the total sugar out-put of the world.

The *Weekly Bulletin* of the Department of Trade and Commerce, Canada, October 14, 1918, draws attention to the transformation of Mesopotamia under British occupation. It is predicted that it will become one of the world's great agricultural countries. This year's harvest is expected to be the greatest in historic times, in spite of war conditions. The British are reported to have dug out more than 100 canals, formerly used for irrigation purposes in connexion with the river Euphrates, but disused for many years. As a result, some 320,000 acres have been brought afresh under cultivation.

The prices of West Indian essential oils, as reported in the *Perfumery and Essential Oil Record*, September 1918, seem to be remunerative. Very little bay oil was then on the market, and the price had hardened to 22*s.* per lb. With regard to lime oil, 7*s.* to 7*s.* 6*d.* was quoted for West Indian distilled, and 16*s.* 6*d.* to 17*s.* 6*d.* for hand-pressed. Orange oil was quoted at 11*s.* to 12*s.* per lb. for sweet Calabrian, while West Indian orange oil commanded 9*s.* to 9*s.* 6*d.* per lb. For pimento oil 22*s.* to 25*s.* per lb. was wanted.

The principal raisin-producing countries of the world are Greece, California, Turkey, Spain, and Australia. Greece produces 60 per cent. of the total world production, almost entirely in the shape of currants, and California comes next with 22 per cent. of raisins. The California crop increased from 40,000 to 128,000 tons (220 per cent.) between 1904 and 1915. During the same period the crop of Australia increased 126 per cent., while that of Spain decreased 26 per cent. The crops of Turkey and Greece were practically stationary. (*Bulletin No. 298*, University of California Publications.)

POP CORN.

By West Indians the term 'pop corn' is always applied to the grains of Guinea corn when subjected to the influence of dry heat, causing them to turn inside out. In the United States, however, and in Australia, the term is usually applied to a variety of maize which is employed in the same way as West Indians employ Guinea corn. It does not seem that this variety of maize has ever been cultivated in these islands. It might be worth while experimenting with, especially in small plots or home gardens. The following description, taken from the *Agricultural Gazette of New South Wales*, August 1918, is of interest:--

Pop corn belongs to a group or race of maize known botanically as *Zea mays*, var. *everta*, on account of its tendency to evert or turn inside out on the application of heat. It is a delicacy which is greatly enjoyed by children, and deserves some encouragement because of its food value and its wholesomeness compared with many other sweets which are craved for at times by young people. It is also of interest on account of the amusement it affords in the actual operation of popping

Pop corn differs from other maize in its smaller and more slender growth of stalks, smaller cobs, and smaller grain. The ears of pop corn are seldom longer than 8 or 9 inches at their best, and the size of the grain is such that it takes from 2,000 to about 3,000 to weigh a pound.

The grain itself is more like flint than dent maize in composition, but has even less soft starch than those common varieties. It consists entirely of germ and horny starch. The best pop corn should show but little trace of soft or white starch, at least on the exterior of the grain.

The cause of popping is not thoroughly understood, but it is supposed to be due to the expansion of air and moisture inside the grain.

It is essential that pop corn should fully mature in order to pop properly, as when the filling of the grain is checked by frost or cold weather it gives an unsatisfactory sample for popping.

Owing to the smaller growth of pop corn, it may be sown closer than field varieties, the distance between the rows recommended being 3 to 4 feet.

The grain should not be sown too deeply, especially with an early planting. From 1 to 2 inches is sufficient under most circumstances. The surface should be harrowed lightly while the plants are small, and afterwards cultivated to a shallow depth to keep down weeds, and to keep the soil loose.

Pop corn should be allowed to mature thoroughly on the stalk. It should not, under any circumstances, be harvested immature.

Many home garden plots of pop corn are grown for the purpose of amusing children with the operation of popping, and at the same time providing a nutritious sweetmeat. The soil should be well enriched with stable manure some months in advance of sowing, and, owing to the manner in which the plants are pollinated, at least three rows should be grown in order to get a good setting of grain.

In order to get the corn to pop properly it must be thoroughly air-dry, i.e, containing about 12 to 14 per cent. of moisture. If too moist, a lot of charred and swollen corn will be the result. It may sometimes happen that the corn has become too dry for successful popping. This is easily remedied by either sprinkling with or soaking in water, and subsequent air-drying.

The source of heat shou'd be fairly strong. A glowing bed of coals gives the best results with the open-wire poppers, where a flame fire is objectionable on account of the ease with which the corn may be scorched. Where a pan popper is used a flame fire is all right. A large amount of corn should not be put into the popper at once, but just enough to cover the bottom of the popper, and the popper should be kept constantly agitated to prevent burning or scorching of the grain. Popping should take place in about a minute and a half with the right degree of heat and good corn. The popped product has from ten to twenty times the bulk of the original corn.

Popped corn is chiefly used as a form of confectionery. The application of heat in popping has the effect of breaking down the fibre in the grain to a large extent, thus rendering it more digestible.

The addition of a little salt after popping is usually required, and most of the popped corn sold by confectioners also has a coating of melted butter and sugar to improve its flavour. Popped corn also makes a good breakfast food when used with milk and sugar. In nearly all cases there will be a small percentage of parched unpopped grains left after popping. These can be well used as a breakfast food by boiling and serving with milk or cream and sugar.

Popped corn loses its crispness readily after popping, on account of absorption of moisture from the air. With the loss of the crispness the flavour also largely disappears; so that popped corn should not be kept for any time to enjoy it at its best. For this reason popped corn is usually sold in waxed or oiled paper bags to prevent it absorbing moisture.

AGRICULTURE IN BARBADOS.

Although December has not brought as much rain as we should have liked, still prospects are better than at this date last year. Both October and November last year were unfavourable, and, being followed by a dry December, crops of all kinds suffered materially. This year the moisture accummulated in the soil during October and November has enabled it to hold its own during the recent absence of frequent showers.

Unlike last year, weather conditions have given no cause for hesitation in planting. Planters have found the land sufficiently moist for their purpose. The fields planted in October and early in November are making a good showing.

It would now appear that about half the crops of the island will be planted in the B. 6450, the remaining half being planted in the B.H. 10 (12) and the Ba. 6032—with small areas of other seedlings such as the B. 6308, the Ba 11,569, the B. 3922, and a negligible area in the B.376.

The local Agricultural Show was held on the 4th instant at Drax Hall Plantation, St. George. The show was quite as successful as that held last year at Lancaster. The exhibits reached a good standard, and they were well grown and properly selected. There is no doubt that these local shows have stimulated peasants, and have taught them what is meant by marketable produce. The exhibits from elementary school gardens also reached a good mark, and for the third time prizes were offered to boys of elementary schools for cane-hole digging, etc. This competition was a keen one, and some very good work was done. (The Barbados *Agricultural Reporter*, December 14, 1918.)

PLANT DISEASES.

DISEASES OF COCO-NUT PALMS IN GRENADA.

MYCOLOGIST'S REPORT.

(*Concluded.*)

The little-leaf disease, so far as could be learned, is up to the present only of occasional and scattered occurrence. I saw examples among young trees in plantations at the north end of the island and on the west coast. Its first manifestation is the appearance, in succession to normally developed leaves, of diminutive leaves which are commonly more or less bent or twisted. There is some brown spotting of the leaflets in evidence before they unfold, and the base of the petiole is affected with a firm brown rot which does not usually penetrate very deeply. The treatment applied has been the laying bare of the seat of the injury by cutting away the strainer and some of the adjacent outer leaves, and the pouring of salt-water, cassava water, Jeyes' fluid, or Bordeaux mixture into the heart. The disease is likely to have a fatal termination, often apparently owing to infestation of the damaged spots with palm weevil; but I saw several cases in which normal growth had been resumed, and recovery appeared complete.

The disease appears to be due to an infection with a fungoid or bacterial organism, the identity of which I have not yet had time to determine. There appears to be no relation to bud rot, nor is there any evidence of relation to the dwindling of the leaves sometimes seen in old trees. S. F. Ashby attributes a similar disease in Jamaica to the action of a species of yeast.

I recommend in cases of this disease that the strainer be carefully cut away, and the leaves opened out as far as can be done without injury. The cutting of the tissues, or any violent injury is to be deprecated, on account of the danger of attracting palm weevil. The affected region should then be well covered with Bordeaux or Burgundy mixture which adheres very much better if milk (which may be separated or skimmed) is used in its preparation, in the proportion of ½ pint in each gallon.

A thick mixture, which may be expected to be particularly suited to this purpose, and which is easily made up in small quantities, may be prepared according to the following formula :—

Copper sulphate—4 oz. dissolved separately in 3 pints of water.

Washing soda—5 oz. in 1 pint of water.

Mix when dissolved, and add 1 pint of milk if it can be obtained. The mixture may be poured or swabbed into the heart, but is far more effectively and economically applied by any kind of sprayer, pushing the nozzle well down between the leaves. The idea of this treatment is to give the tender parts a coating which is protective against infection, and it should be repeated when it is judged to be necessary from this point of view. Where the tissues are cut or split, a local application of carbolineum might be tried, to keep out palm weevil.

The 'home remedies' referred to above are all open to the objection that their ingredients are readily soluble, and must be quickly washed away by rain.

The third type of affection noted, the condition of debility due to want of drainage, root interference from other trees, or exhausted or untilled soil will be dismissed briefly, as being well within the planter's power to deal with by purely agricultural methods. It is only necessary to outline the distinctive features of the condition. The mature leaves take on a general yellow or even reddish-brown colouration ; usually the whole top has a sickly appearance ; fruit production dwindles, or in old cases almost ceases ; leaves and often fruit become infested with the round papery scale insect (*Aspidiotus destructor*). The trees do not die, but make poor growth. New leaves remain green but a short time. When the unfavourable condition is temporary, as in the case of water-logging from floods or blocked drains, the yellow colour appears suddenly, and is soon removed when the roots are again set free to breathe. The remedies are drainage, cultivation, and in some cases manuring.

The first essential in dealing with the subject of bud rot is to insist on discrimination between rotting of the bud in general, and the infectious disease known as bud rot in particular. The existence of a stinking rot of the heart is not evidence of the specific bud rot disease. Bacterial putrefaction of the enclosed tissues of the heart appears to be as natural in a dead or dying coco nut tree as it is in the case of the internal organ of a dead animal. It is seen in trees which die of root disease, and still less equivocally, has occurred in an experiment made by the writer, within two weeks of the insertion into the base of a vigorous tree of an ounce of sodium arsenate. In spite of much investigation the only character by which the infectious bud rot can be certainly recognized is by its infectiousness. It may first attack the heart of the tree, or it may start at any point among the outer leaves or flower and fruit bundles, reaching the heart only after many months. In both forms the stem and roots remain healthy to the last.

The only cases seen during this visit which I regarded as suspicious were those of some half-dozen mature bearing trees on one estate, in which groups of outer leaves, not the oldest, were discoloured and drooping. These trees I have asked the Superintendent of Agriculture to keep under observation. If the affection shows signs of progressing, it will be advisable that they should be fired and sprayed, and if that does not suffice, cut down and burnt.

Wm. Nowell.

COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended November 9, 1918, is as follows:—

ISLANDS. We have had a continuance of a very dull market, with only limited inquiry, but no demand; consequently no sales are reported.

The unsold stock is gradually accumulating, which renders the factors more desirous of selling. During this period of unsettled business, they continue to hold nominally for prices last paid, but, should any actual demand spring up, they will probably be willing to make a decided concession in price to sell.

Therefore we quote, nominally:—

Fine to Fully Fine 72c., f.o.b. and freight

GEORGIAS AND FLORIDAS. The market in Savannah, and throughout the interior, has remained very quiet, with limited demand.

Under the present disorganized and unsettled conditions of business everywhere, there is a general indisposition to do anything, and in consequence, it is impossible to give any established quotations. The sales reported are made at very irregular prices, depending upon the requirements or wishes of the holders of the unsold stock, which is accumulating at all interior points.

We can buy to-day, in a limited way:—

Fancy 65c. f.o.b. and freight.
Extra Choice 64c. „ „ „

The exports from Savannah for the week have been to Northern Mills 826 bales; and from Jacksonville to the Northern Mills, 253 bales.

The shipments from Savannah were largely made by George H. McFadden & Bros.' Agency, which are reported to be Government cotton held there on storage, and now being forwarded.

THE JAMAICA IMPERIAL ASSOCIATION.

At the quarterly meeting of the Council of this Association, held at Kingston, Jamaica, on October 16, 1918, the report of the work of the Executive Committee of the Association was presented.

This report is dealt with in the Jamaica *Gleaner*, October 19, 1918, from which the following items are taken, showing the activity of the Association, and the benefits likely to accrue to the colony from its public spirited efforts.

Since the last meeting of the Council on June 26 the Executive Committee of the Association has devoted itself particularly to efforts looking to the maintenance and development of Jamaica industries. The most important of these efforts may be arranged under the following heads:—

(1) The obtaining of shipping facilities for Jamaica.
(2) The development of the sugar industry.
(3) The procuring of a better price for Jamaica sugar.

The question of shipping facilities for the removal of produce from the outports has also been engaging the Executive Committee's attention. Representations on this matter have been made to the proper authorities, and it is confidently hoped and believed that satisfactory arrangements will be made to facilitate exports.

The Executive Committee, in view of the fact that nothing had been done for over a year to settle on practical lines the central sugar factories question, decided to take this question up with the Governor in connexion with the Jamaica Sugar Committee. The Chairman of the Jamaica Sugar Committee was accordingly invited to associate himself with the Executive Committee for the purpose of urging upon the Governor the necessity of pushing on with a programme of sugar development. A lengthy letter, tracing the history of the sugar development movement in Jamaica from October 1914, was prepared and despatched to His Excellency. As the Secretary of State for the Colonies did not accept the scheme prepared by Sir Francis Watts, and adopted by the Legislative Council, but had insisted upon permanent Government control in any central factory scheme and also upon the Government sharing the profits of such venture (unless one-fifth of the money required were found by cane farmers interested in a central factory), the Executive Committee with the Chairman of the Jamaica Sugar Committee, thought it advisable to support the original scheme of the Sugar Committee. That, as generally known, provides for a division of the profits between the Government and the cane farmers as follows: the canes to be purchased by the cane farmers on a 5 per cent. basis, 25 per cent. of the net profits of the undertaking to go to the Government in perpetuity, and 75 per cent. to go to the cane farmers. In regard to parishes which may already have an established sugar industry, and which may desire to amalgamate their several concerns into one or two great central factories, the proposal is that the Government should advance them two-thirds of the capital required, on their giving adequate security for the repayment of the loan.

His Excellency has, since the receipt of the Committee's letter, had an interview with the Chairman of the Association, and has made some counter suggestions to be considered by the representatives of the Imperial Association and the Jamaica Sugar Committee. It is understood that His Excellency is prepared to push on with sugar developments on the basis of the scheme which will shortly be placed before the sugar producers and the country.

In view also of the danger of the island's depending on the banana industry in the future as much as it did in the past, the Executive Committee is strongly of the opinion that no means should be neglected of placing Jamaica's sugar industry on a broad and stable foundation without delay.

It was recently brought to the attention of the Executive Committee that Cuban sugar producers obtained a better price f.o.b. for their sugar than the sugar producers of Jamaica. The Committee at once took this matter up with the local Government, with the Sugar Commission of London, with the West India Committee, and with Mr. J. R Bruce of the International Sugar Commission of Canada. It also communicated with the Chambers of Commerce of Barbados, Demerara, Trinidad, and Antigua, asking their co-operation and the co-operation of their several Governments in its efforts to obtain a better price for Jamaica sugar. The Government of Jamaica has supported, on the Executive Committee's request, this move on the part of the Jamaica Imperial Association; and the Chambers of of Commerce in the colonies mentioned have promptly co-operated with this Association in this matter. The Sugar Commission of London replied to the Association to the effect that 'f.o.b. prices for British West Indian sugars will be governed by prices fixed for Cuban crop, which, however, have not yet been determined.'

The difficulty of estates obtaining machinery at present is another matter that has been brought particularly to the Executive Committee's attention. The Committee has therefore made it known to those approaching it in this matter that it will do its very best to place the needs of Jamaica for machinery before the Imperial Authorities.

With regard to agricultural implements, the Association has moved the West India Committee to endeavour to obtain the steel necessary for the making of such implements.

Cotton cultivation to a limited extent has been tried in Queensland with su | —, 46,977 lb. having been accepted by the D 230. | —, future in May 1918 as against 10,1 arch work, 72. | — C

The Boards of Trade Journal, Oc

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, October 31.

ARROWROOT—1/7 to 1/9.
BALATA—Venezuelan Block, 3/7; Sheet, 4/1½.
BEESWAX—No quotations.
CACAO—Trinidad, 90/-; Grenada, 85/-; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, 238/- to 251/-.
LIME JUICE—Raw, 4/- to 4/6; concentrated, quiet; Otto of lime (hand-pressed), 15/- to 16/ .
LOGWOOD—No quotations.
MACE—3/4 to 3/9.
NUTMEGS—3/- to 3/9,
PIMENTO—6¾*d.* to 7*d.*
RUBBER—Para, fine hard, 3/-; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., October 4.

CACAO—Venezuelan, no quotations; Trinidad, no quotations.
COCO-NUT OIL—$1·46 per gallon.
COFFEE—Venezuelan, 15c. per ℔.
COPRA—$7·25 per 100 ℔.
DHAL—$11·50 to $12·00 per bag.
ONIONS—$10·00 per 100 ℔.
PEAS, SPLIT—$8·00 per bag.
POTATOES—English, $4·00 per 100 ℔.
RICE—Yellow, $13·00 to $13·25; White, $9·00 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs GILLESPIE BROS & Co., November, 14.

CACAO—Caracas, 14¾c. to 15c.; Grenada, 14¼c. to 14¾c.; Trinidad, 14½c. to 15c.; Jamaica, 12¾c.
COCO-NUTS—Jamaica selects, $51·00; Trinidad $52·00 culls, $28·00 to $29·00 per M.
COFFEE—Jamaica, 14c. to 17c. per ℔.
GINGER—17c. to 20c. per ℔.
GOAT SKINS—Importation prohibited.
GRAPE FRUIT—Jamaica, $2·50 to $4·00.
LIMES—Nominal.
MACE—43c. to 45c. per ℔.
NUTMEGS—30c.
ORANGES—$2·50 to $3·50.
PIMENTO—9c. to 9¼c. per ℔.
SUGAR—Centrifugals, 96°, 6·055c; Muscovados, 89°, 5·155c Molasses, 89°, 5·052c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 18.

ARROWROOT—$12·00 per 100 ℔.
CACAO—$12·00 to $12·50 per 100 ℔.
COCO-NUTS—$30·00 husked nuts.
HAY—$3·00.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, no quotations; Patna, no quotations; Rangoon, no quotations.
SUGAR—Dark Crystals, $5·50

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